ARCS V

Remedial Activities at Uncontrolled Hazardous Waste Sites in Region V

United States Environmental Protection Agency

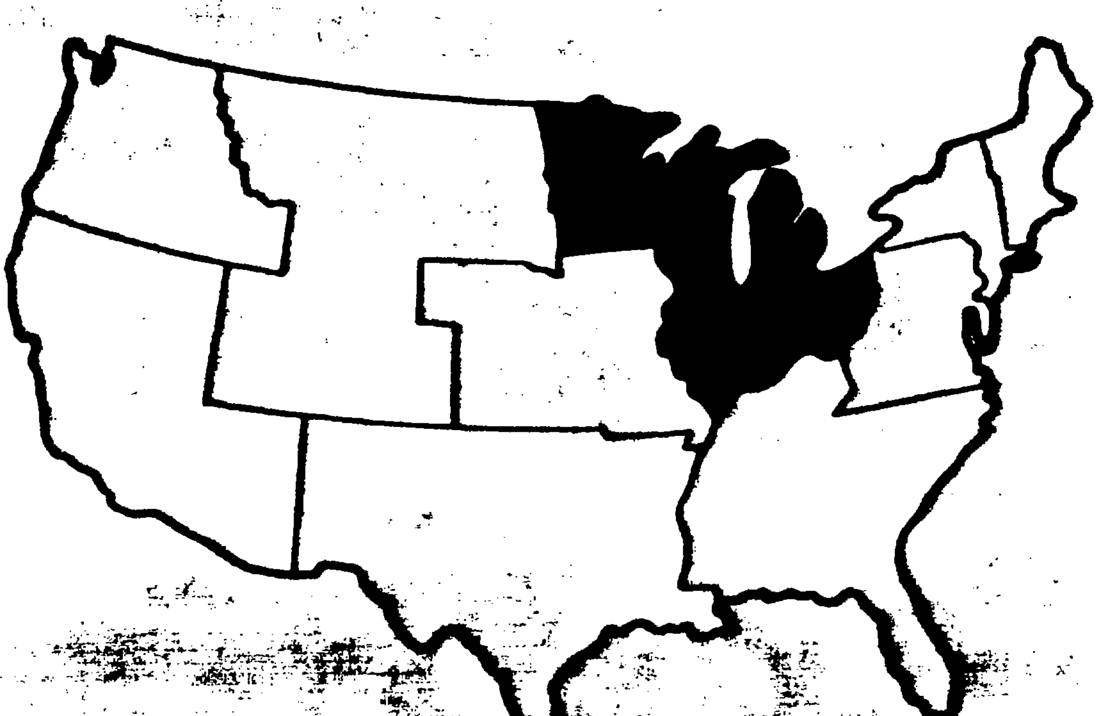
REMEDIAL INVESTIGATION REPORT

VOLUME 2 OF 3

LASKIN POPLAR OIL SITE
Jefferson, Ohio

WA16-5L03.0
Contract No. 68-W8-0040

December 23, 1988



CH2M HILL

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REMEDIAL INVESTIGATION REPORT
Volume 2 of 3

LASKIN POPLAR OIL SITE
Jefferson, Ohio

WA 16-5L03.0 / Contract No. 68-W8-0040

December 23, 1988

GLT810/23-1

Appendix A
PHASE I FIELDWORK MEMORANDUMS

Fieldwork Memorandum A-1
ONSITE SAMPLING SOIL BORING

- SN002--Selected to be downgradient of backfilled Pond 19.
- SN003--Selected to be in the area of the buried ravine.
- SN004--Selected to be near the retention pond and downgradient of the steel storage tanks in the vicinity of the valve control shed and the bailer house.
- SN005--Selected to provide an offsite upgradient background boring/well to replace SN001.

Boring SN006 through SN012 locations were selected to provide areal distribution of the subsurface soil data in the tank and retention pond areas.

The borings were numbered SN001 through SN012 in accordance with Sampling Plan designations for onsite soil samples (SN). Soil samples were not obtained from Boring SN005; it was drilled to install monitoring well GW005. Groundwater monitoring wells were installed in five of the borings, SN001 through SN005. A discussion of the groundwater monitoring well installations is included in Appendix A-3. The remaining seven borings were closed by grouting from the bottom of the boring to the ground surface using a cement-bentonite grout. The as-drilled boring locations were surveyed by establishing a baseline along the site access road, referencing the baseline to existing site features, and obtaining angles from the baseline and distances from baseline end points to each boring.

A boring log for each soil boring and a key to the boring logs are presented on Attachment 1. Each log presents a written description of the bore in accordance with the Unified Soil Classification System, as well as pertinent test data and depths. The soil/rock (shale) interface has been defined as the depth at which the driving resistance of the sampler exceeded 50 blows per 6-inch penetration.

During a previous subsurface investigation at the Laskin Poplar Oil site, Soil Testing Services (STS) of Ohio, Inc. (1981) drilled three borings to depths ranging from 43 to 50 feet. Logs of the STS Borings B-1 through B-3 and a key to the

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FIELDWORK MEMORANDUM A-1

TO: Donna Twickler/Remedial Project Manager, U.S. EPA

FROM: Randy Videkovich/Site Manager, CH2M HILL

RE: Onsite Sampling Soil Boring
Laskin Poplar Oil Site

PREPARED BY: Woodward-Clyde Consultants

DATE: August 20, 1986

REVISED BY: CH2M HILL, February 25, 1988

This memorandum was prepared by Woodward-Clyde Consultants for the Phase I RI under REM/FIT Contract No. 68-01-6692, Work Assignment 32.5L03.0. It has subsequently been revised by CH2M HILL during the Phase II RI/FS. Revisions are limited to format changes.

GENERAL

Soil samples were obtained from 12 soil borings during the periods of October 5 to 12, and November 12 to 19, 1983. Borings were advanced using hollow-stem augers powered by a trailer-mounted drill rig. The boring locations are shown on Figure A-1-1. Boring locations were established during the site reconnaissances on October 4, 1983, and November 14, 1983. Boring locations were selected based on existing site data and visual observations. They were located in areas that were expected to be representative of potentially contaminated areas and to provide information regarding the quality, level, and direction of groundwater flow. Five boring locations were selected for subsequent installation of monitoring wells.

- SN001--Selected to provide an upgradient boring/-well within the site boundaries. After drilling, the boring was determined not to be suitable to provide upgradient data because of a suspected hydraulic connection between the boring and the nearby freshwater pond. Another location (SN005) was selected to provide upgradient background data.

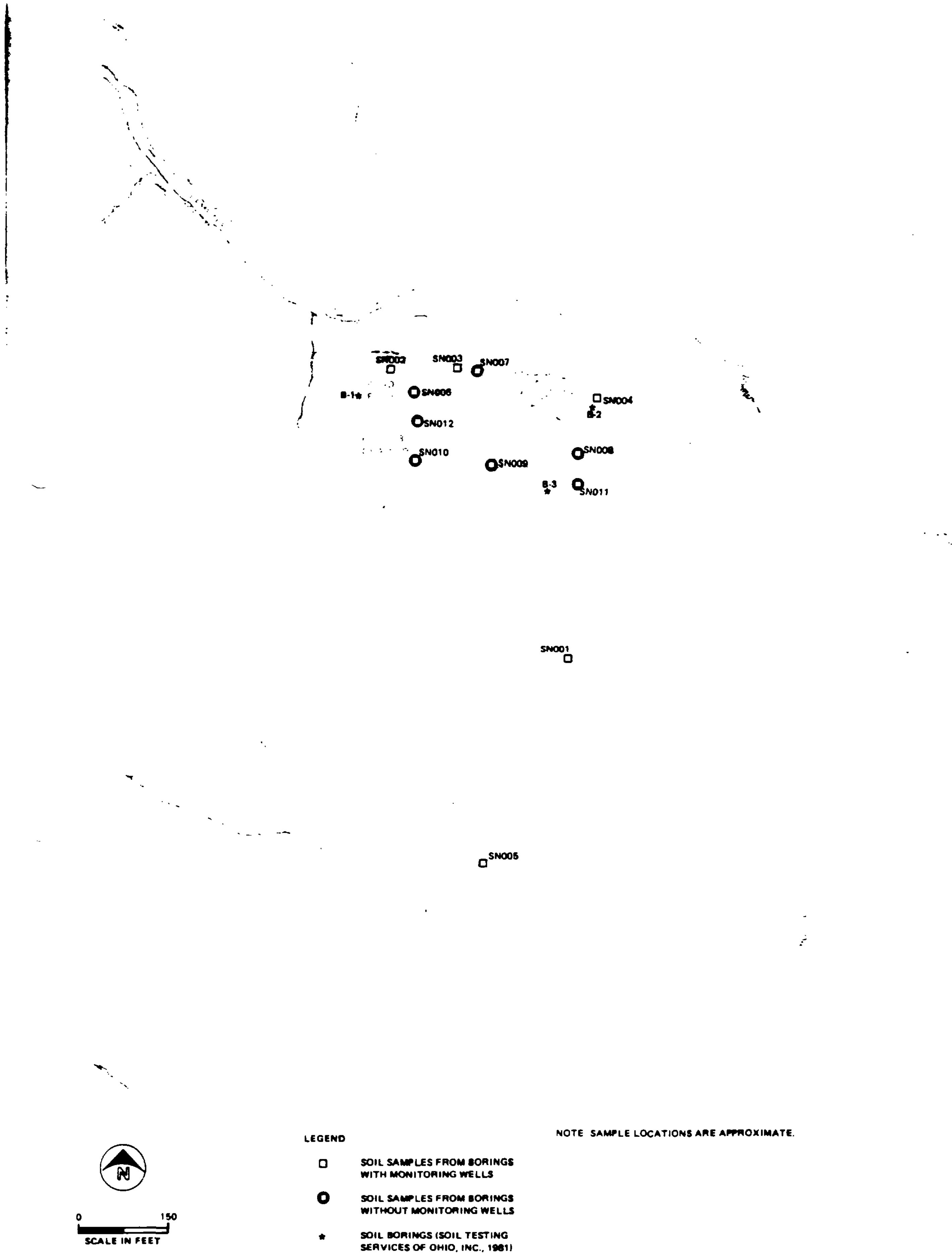


FIGURE A-1-1
SOIL BORING LOCATIONS
LASKIN POPLAR OIL

boring logs are presented on Attachment 2. The locations of the STS borings are shown on Figure A-1-1.

SAMPLING PROCEDURES

With the exception of Boring SN012, soil samples were obtained at every 1.5 feet (continuous sampling) from the ground surface to a depth of 10 feet, and at 2.5-foot intervals from 10 feet to the termination depth of the borings or until competent bedrock was encountered. In SN012, soil samples were obtained at 2.5-foot intervals from the ground surface to the termination depth at 26.5 feet. Soil samples were obtained by driving a 3-inch-diameter steel, split-barrel sampler 1.5 feet with a free-falling, 140-pound hammer in substantial accordance with the procedures of ASTM D 1586. Blowcounts were noted for each 6-inch of penetration. Blowcounts, time of sampling, and depth of sampling interval were logged in the field book.

Once the sample had been obtained, the split-barrel sampler was opened and the sample placed in a stainless steel pan. The sample was measured for recovery and logged with respect to color, material type, and texture. The data were entered into the field book. Samples were periodically scanned for the presence of VOCs with the flame or photoionization detectors, and the data were recorded in the field book.

Each sample was cut with a stainless steel knife into 6-inch-long increments, beginning at the top of the sample. The 6-inch samples were then cut longitudinally into quarters. Two of the quarters were placed in 8-ounce glass sample jars. Duplicate samples were taken every tenth 6-inch sample interval. The jars were placed in coolers for temporary storage and subsequent transportation from the site.

Blank samples were taken every twentieth 6-inch sample interval. Blank samples consisted of diatomeceous earth that had been placed in the split-barrel sampler used during sampling. The blank sample was spooned from the filled split-barrel sampler into 8-ounce glass jars with a stainless steel spoon.

From the samples obtained, 71 samples were selected and submitted to the U.S. EPA Contract Laboratory Program for HSL organic and inorganic constituent testing. Samples were selected for testing at approximate 4- to 5-foot intervals starting 0.5 foot below the ground surface. Of the 71 tested samples, 7 were duplicates and 4 were blanks.

Representative cohesive soil samples were tested in Woodward-Clyde Consultants Solon, Ohio, geotechnical laboratory for selected index properties. The gravel, sand, and fines contents of five samples, one from each of five borings, were determined by sieve analysis using the No. 4 and 200 sieves. Atterberg (liquid and plastic) limits of the fine portion were determined for each sample. These data are noted for the appropriate sample in the boring logs and are summarized in Table A-1-1.

Sampling equipment used during the field investigation was decontaminated before each sampling event. Decontamination consisted of a detergent wash (sodium carbonate and trisodium phosphate) and rinsing with tap water, acetone, hexane, and distilled water. Equipment was allowed to air dry. During wet weather, however, the sampling equipment was wiped dry with paper towels. During soil drilling, the drill rig and tools were steam cleaned prior to each boring. The bulldozer used to move the drill rig and the dump truck used to transport gravel were steam cleaned before leaving the site.

Sample jars containing samples from soil borings SN001 through SN004 were decontaminated with a detergent wash and rinsed with tap water, acetone, hexane, and distilled water. Headspace analyses of sample jars were performed using both flame and photo ionization detectors. Headspace analyses of both full and empty sample jars that had been decontaminated by the above procedure indicated that acetone, hexane, or both, may have been contaminating the sample jars during the decontamination process. The data obtained from the headspace analyses are given in Table A-1-2. Decontamination of the sample jars for the remainder of the field investigation was modified to include only a detergent wash and distilled water rinse.

TABLE A-1-1

SUMMARY OF ENGINEERING PROPERTIES DATA

ON-SITE SOIL SAMPLES

	Atterberg Limits %*		Grain Size Distribution		
Sample No.	Plastic	Liquid	% Gravel	% Sand	% Fines**
SN001-027	18	30	3.6	25.3	71.1
SN002-053	21	37	34.6	21.9	43.5
SN004-041	24	41	5.6	10.6	83.8
SN008-039	22	36	6.4	23.4	70.2
SN009-015	20	31	6.6	24.1	69.3

* Atterberg Limits expressed as the sample moisture content in percent.

** % Fines - silt and clay-size soil particles as determined by the percent of material passing a No. 200 sieve.

TABLE A-1-2

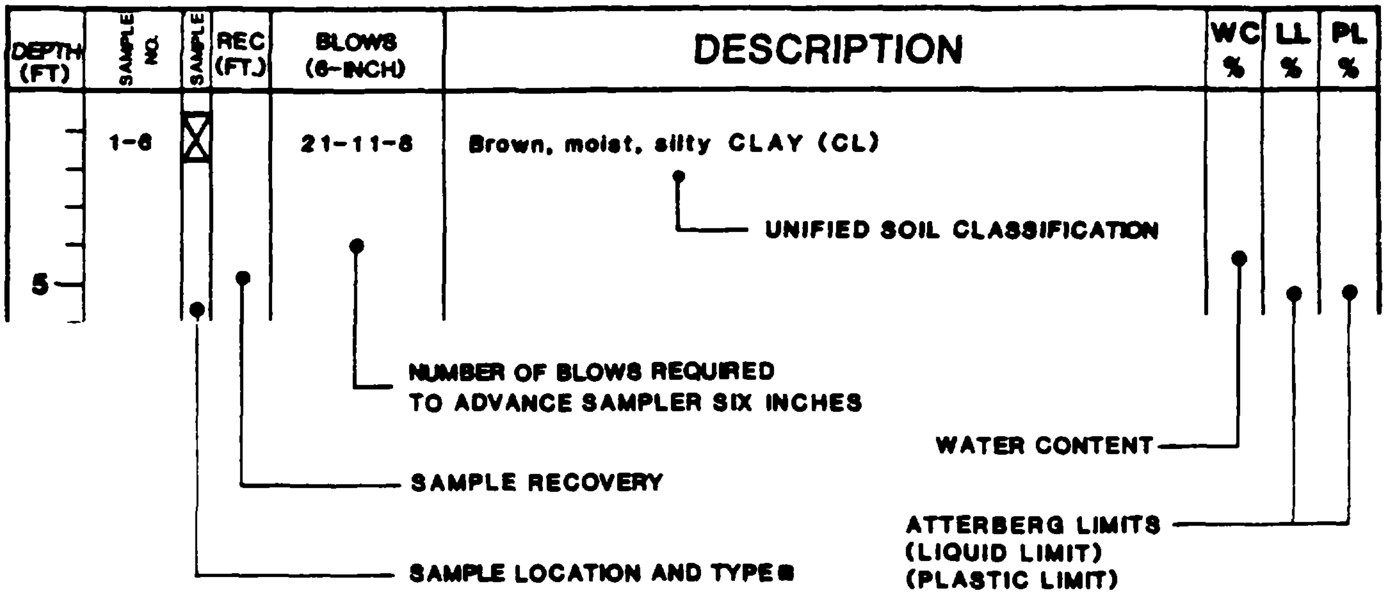
HEAD SPACE ANALYSIS OF SOIL SAMPLE JARS

SAMPLES SN001 THROUGH SN004

	NUMBER JARS TESTED	HIGH*	LOW	MEAN	STANDARD DEVIATION
Flame Ionization Detector					
Decontaminated sample jars containing samples	124	1000	1.8	56.8	96.9
Decontaminated sample jars, empty	22	100	0	44.0	40.7
Unused sample jars not decontaminated	6	0	0	0	0
Photo Ionization Detector					
Decontaminated sample jars, containing samples	124	138	0	25.4	24.7
Decontaminated sample jars, empty	22	200	0	28.9	46.1
Unused sample jars, not decontaminated	6	0	0	0	0

*Note: Where the meter read greater than the meter range, the maximum reading was used. All readings in ppm.

Attachment 1
FIELDWORK MEMORANDUM A-1



■ 3-INCH O.D. SPLIT-BARREL SAMPLER DRIVEN BY A 140 POUND HAMMER FALLING 30 INCHES

KEY TO LOG OF BORINGS

LASKIN-POPLAR OIL, JEFFERSON, OHIO

LOCATION FIG A-1-1
DRILLING METHOD 3" SPLIT SPOON
SURFACE ELEVATION 918.4'

DATE DRILLED 5 Oct. 1983
WATER LEVEL 5.3' (913.1')
DATE MEASURED 12 Oct. 1983

DEPTH (FT)	SAMPLE NO.	REC (FT.)	BLOWS (6-INCH)	DESCRIPTION	WC %	LL %	PL %
	1-6	1.3	6-15-12	Brown, damp, silty CLAY (CL) with rock fragments and organics, FILL			
	7-12	1.2	16-20-20				
	13-18	0.7	6-18-16	Brown and gray, damp to moist, silty CLAY (CL) with sand and rock fragments.			
5	19-28	1.0	10-15 17-21			30	18
	29-34	1.0	13-15				
	33-36	1.0	14-20				
	37-40	1.0	16-25				
10	41-48	1.0	8-19				
	49-54	1.4	9-19-34				
15	55-60	1.4	12-21-33	Gray, damp, silty CLAY (CL) with shale fragments (decomposed SHALE)			
	61-68	1.0	15-100	-Becoming heavily weathered to weathered SHALE			
20	69-74	1.0	46-100				
		0	50/.3				
25							
				Termination depth at 27.5 Ft			
30							

LOG OF BORING SN001
LASKIN-POPLAR OIL, JEFFERSON, OHIO

DRAWN BY: REM | CHECKED BY: KCM | PROJECT NO: 83C091B | DATE: 10-16-84

LOCATION FIG A-1-1 **DATE DRILLED** 8 Oct. 1983

DRILLING METHOD 3" SPLIT SPOON **WATER LEVEL** 14.6' (889.3')

SURFACE ELEVATION 903.9' **DATE MEASURED** 12 Oct. 1983

DEPTH (FT)	SAMPLE NO.	SAMPLE	REC (FT.)	BLOWS (6-INCH)	DESCRIPTION	WC %	LL %	PL %
	1- 6	X	1.0	2-4-4	Brown, moist, silty CLAY (CL) with rock fragments and organics, FILL			
	7-10	X	0.6	4-4				
	11-14	X	0.1	2-2				
	15-18	X	0.9	2-3				
5	19-24	X	0.3	2-6				
	25-28	X	0.9	2-5				
	29-32	X	0.9	2-1				
	33-40	X	0.8	2-2	Gray and black, moist to wet, silty CLAY (CL) with organics and wood, FILL			
10	41-46	X	1.3	3-4-6				
	47-52	X	1.5	2-2-3	Brown and gray, moist, silty CLAY (CL) with sand and rock fragments			
15	53-58	X	1.5	4-8-10	Gray, moist, silty CLAY (CL) with shale fragments (decomposed shale)		37	21
	59-64	X	1.3	24-77-100/.3	-Becoming heavily weathered to weathered SHALE			
20	65-66	X	0.2	100/.3				
25					Termination depth at 24.0Ft			

LOG OF BORING SN002

LASKIN-POPLAR OIL, JEFFERSON, OHIO

DRAWN BY: REM	CHECKED BY: KCM	PROJECT NO: 83C091B	DATE: 10-16-84	FIGURE NO:

LOCATION FIG A-1-1 DATE DRILLED 10 Oct. 1983
DRILLING METHOD 3" SPLIT SPOON WATER LEVEL Dry
SURFACE ELEVATION 905.9' DATE MEASURED 12 Oct. 1983

DEPTH (FT)	SAMPLE NO.	SAMPLE	REC (FT.)	BLOWS (6-INCH)	DESCRIPTION	WC %	LL %	PL %
	1-4	X	0.8	3-5	Brown, moist, sandy SILT (ML) with rock fragments, brick and clay, FILL			
	5-8	X	1.0	7-11				
	9-12	X	1.0	3-16	Brown and gray silty CLAY (CL) with sand, tar, and rock fragments, FILL			
	13-16	X	1.0	5-12				
5	17-22	X	1.0	6-10				
	23-26	X	1.0	7-10	...silt layer			
	27-30	X	0.9	5-8				
	31-34	X	0.9	5-7	...wood			
	35-38	X	0.8	3-6	...becomes gray			
10	39-48	X	1.5	3-4-7	Gray, moist, silty CLAY (CL) with wood, organics, brick and rock fragments, FILL			
	49-54	X	1.0	4-5-8				
15	55-60	X	0.7	2-5-6	...brown silt layer			
	61-66	X	0.5	5-6-29	...with wood			
20	67-74	X	-	7-9-22	...with wood			
	75-80	X	1.3	86-31-77	Gray SHALE, iron stained and heavily weathered			
	81-82	X	0.5	24				
25								
					Termination depth at 27.0 Ft			
30								

LOG OF BORING SN003
LASKIN-POPLAR OIL, JEFFERSON, OHIO

DRAWN BY: REM	CHECKED BY: KCM	PROJECT NO: 83C0918	DATE: 10-16-84

LOCATION FIG A-1-1
DRILLING METHOD 3" SPLIT SPOON
SURFACE ELEVATION 908.2'

DATE DRILLED 11 Oct. 1983
WATER LEVEL 15.7'
DATE MEASURED 12 Oct. 1983

DEPTH (FT)	SAMPLE NO.	SAMPLE	REC (FT.)	BLOWS (6-INCH)	DESCRIPTION	WC %	LL %	PL %
	1-4	X	0.7	2-6	Brown, moist, sandy SILT (ML) with root fibers, FILL			
	5-8	X	0.0	4-6				
	9-12	X	0.8	6-5	Brown, moist, silty CLAY (CL) with sand, brick and rock fragments, FILL			
	13-16	X	1.0	3-8				
	17-22	X	1.0	4-4				
5	23-26	X	0.8	2-3				
	27-30	X	-	2-3				
	31-34	X	0.9	2-3	Brown to gray, moist silty CLAY (CL) with sand, wood, and rock fragments, FILL			
	35-38	X	0.9	3-2				
10	39-48	X	1.0	3-4	Brown and gray, moist, silty CLAY (CL) with rock fragments		41	24
	49-54	X	1.3	7-11-20	... with decomposed shale			
15	55-60	X	1.3	7-19-24				
	61-68	X	1.3	26-57-100/.4	Heavily weathered SHALE			
20	69-74	X	1.1	23-85-50/.3				
25					Termination depth at 23.5 Ft			

LOG OF BORING SN004
LASKIN-POPLAR OIL, JEFFERSON, OHIO

DRAWN BY: REM | CHECKED BY: KCM | PROJECT NO: 83C0918 | DATE: 10-16-84

LOCATION FIG A-1-1	DATE DRILLED 15 Nov. 1983
DRILLING METHOD 3" SPLIT SPOON	WATER LEVEL 3.5' (911.9')
SURFACE ELEVATION 915.4'	DATE MEASURED 2 Dec. 1983

DEPTH (FT)	SAMPLE NO.	SAMPLE	REC (FT.)	BLOWS (6-INCH)	DESCRIPTION	WC %	LL %	PL %
0–8					Brown, moist silty CLAY (CL) with sand			
8–28					Gray SHALE			
28					Termination depth at 28 Ft Note: No samples obtained, classification from auger cuttings.			

LOG OF BORING SN005

LASKIN-POPLAR OIL, JEFFERSON, OHIO

DRAWN BY: REM	CHECKED BY: KCM	PROJECT NO: 83C0918	DATE: 10-16-84

LOCATION FIG A-1-1

DRILLING METHOD 3" SPLIT SPOON

SURFACE ELEVATION 903.4'

DATE DRILLED 16 Nov. 1983

WATER LEVEL Dry

DATE MEASURED -

DEPTH (FT)	SAMPLE NO.	SAMPLE	REC (FT.)	BLOWS (6-INCH)	DESCRIPTION	WC %	LL %	PL %
	1-6	X	0.8	2-2-4	Brown, moist, silty CLAY (CL) with sand and rock fragments, becoming brown and gray			
	7-12	X	0.8	3-5-5				
	13-18	X	1.0	4-4-4				
5	19-26	X	1.0	4-4-5				
	27-32	X	0.4	2-2-3				
	33-38	X	0.3	1-1-2				
10	39-48	X	1.5	1-2-3				
					Termination depth at 10.5 Ft			
15								

LOG OF BORING SN006

LASKIN-POPLAR OIL, JEFFERSON, OHIO

DRAWN BY: REM	CHECKED BY: KCM	PROJECT NO: 83C0918	DATE: 10-16-84

LOCATION FIG A-1-1 DATE DRILLED 17 Nov. 1983
DRILLING METHOD 3" SPLIT SPOON WATER LEVEL Dry
SURFACE ELEVATION 902.4' DATE MEASURED -

DEPTH (FT)	SAMPLE NO.	SAMPLE	REC (FT.)	BLOWS (6-INCH)	DESCRIPTION	WC %	LL %	PL %
	1-4	X	0.7	6-10-11	Brown and gray, moist, silty CLAY (CL) with sand and rock fragments, FILL			
	5-10	X	1.4	8-10-13	...brick			
	11-16	X	1.2	5-7-10	Gray, moist, silty CLAY (CL)with wood, cinders, brick and rock fragments, FILL			
5	17-24	X	1.0	5-18-21				
	25-30	X	.3	10-7-20	Black, moist, silty CLAY (CL) with cinders, FILL			
	31-38	X	.5	3-5-9	. . . black wood			
10	39-48	X	0.5	5-3-4	. . . black wood chips			
					Termination depth at 10.5 Ft			
15								

LOG OF BORING SN007

LASKIN-POPLAR OIL, JEFFERSON, OHIO

DRAWN BY: REM	CHECKED BY: KCM	PROJECT NO: 83C0918	DATE: 10-16-84

LOCATION FIG A-1-1

DRILLING METHOD 3" SPLIT SPOON

SURFACE ELEVATION 915.8'

DATE DRILLED 17 Nov. 1983

WATER LEVEL Dry

DATE MEASURED -

DEPTH (FT)	SAMPLE NO.	SAMPLE	REC (FT.)	BLOWS (6-INCH)	DESCRIPTION	WC %	LL %	PL %
	1-6	X	1.4	21-20-31	Brown, moist, silty CLAY (CL) with sand, asphalt and gravel, FILL			
	7-12	X	1.0	6-6-8	Black, silty SAND (SM) with oil, FILL			
	13-18	X	0.8	3-5-5	Brown, moist, silty CLAY (CL) with black sand zones, FILL			
5	19-26	X	0.7	3-3-4				
	27-32	X	1.1	13-6-8	...with black and gray, silty sand and tar chips			
	33-38	X	1.5	5-11-23	...becomes gray with rock fragments			
					Brown and gray, moist, silty CLAY (CL)			
10	39-48	X	1.2	6-10-19	Brown, moist, silty CLAY (CL) with rock fragments		36	22
					Termination depth at 10.5 Ft			
15								

LOG OF BORING SN008

LASKIN-POPLAR OIL, JEFFERSON, OHIO

DRAWN BY: REM | CHECKED BY: KCM | PROJECT NO: 83C0918 | DATE: 10-16-84

LOCATION FIG A-1-1		DATE DRILLED	18 Nov. 1983
DRILLING METHOD	3" SPLIT SPOON	WATER LEVEL	Dry
SURFACE ELEVATION	919.4'	DATE MEASURED	-

DEPTH (FT)	SAMPLE NO.	SAMPLE	REC (FT.)	BLOWS (6-INCH)	DESCRIPTION	WC %	LL %	PL %
	1-6	X	1.0	17-20-21	Brown, moist, silty SAND (SM) to silty CLAY (CL) with slag, glass, tar and rock fragments, FILL			
	7-12	X	1.2	5-8-15	Brown and gray, moist, silty CLAY (CL) with rock fragments			
	13-18	X	1.2	4-8-9			31	20
5	19-26	X	0.8	4-4-5				
	27-32	X	1.1	3-3-5				
	33-38	X	0.8	3-4-5				
10	39-48	X	1.3	3-3-5				
					Termination depth at 10.5 Ft			
15								

LOG OF BORING SN009

LASKIN-POPLAR OIL, JEFFERSON, OHIO

DRAWN BY: REM	CHECKED BY: KCM	PROJECT NO: 83C0918	DATE: 10-16-84

LOCATION FIG A-1-1		DATE DRILLED	18 Nov. 1983
DRILLING METHOD	3" SPLIT SPOON	WATER LEVEL	Dry
SURFACE ELEVATION	922.3'	DATE MEASURED	-

DEPTH (FT)	SAMPLE NO.	SAMPLE	REC (FT.)	BLOWS (6-INCH)	DESCRIPTION	WC %	LL %	PL %
	1-6	X	1.2	41-46-47	Brown, moist, silty CLAY (CL) with sand and vegetation, FILL			
	7-12	X	1.1	13-24-10	Black, moist, silty SAND (SM) with slag, brick and concrete, FILL			
	13-18	X	0.8	47-60-H				
5	19-26	X	1.2	4-8-10	Brown, moist, silty CLAY (CL) with brick and gravel, FILL			
	27-32	X	1.0	6-7-12	Brown and gray, moist, silty CLAY (CL) with rock fragments and sand, FILL			
	33-38	X	1.0	5-5-5	...with decayed vegetation			
10	39-48	X	1.5	3-4-6				
					Termination depth at 10.5 Ft			
15								
					H - Hit rock fragment			

LOG OF BORING SN010

LASKIN-POPLAR OIL, JEFFERSON, OHIO

DRAWN BY: REM	CHECKED BY: KCM	PROJECT NO: 83C0918	DATE: 10-16-84

LOCATION FIG A-1-1 | DATE DRILLED 18 Nov. 1983

DRILLING METHOD 3" SPLIT SPOON | WATER LEVEL Dry

SURFACE ELEVATION 915.8' | DATE MEASURED -

DEPTH (FT)	SAMPLE NO.	SAMPLE	REC (FT.)	BLOWS (6-INCH)	DESCRIPTION	WC %	LL %	PL %
	1-6	X	1.0	21-40-50	Brown and black, moist, silty CLAY (CL) and SAND (SM) with gravel, slag, brick, asphalt and rock fragments FILL			
	7-12	X	1.4	16-17-20				
	13-18	X	1.2	12-20-14	Gray, moist, silty CLAY (CL) with black slag, sand and rock fragments, FILL			
5	19-26	X	1.3	6-18-27	Brown and gray, moist, silty CLAY (CL) with rock fragments			
	27-32	X	1.3	7-17-20				
	33-38	X	1.4	6-13-20				
10	39-48	X	1.5	6-23-37				
					Termination depth at 10.5 Ft			
15								
20								

LOG OF BORING SN011

LASKIN-POPLAR OIL, JEFFERSON, OHIO

DRAWN BY: REM | CHECKED BY: KCM | PROJECT NO: 83C091B | DATE: 10-16-84

LOCATION FIG A-1-1	DATE DRILLED 19 Nov. 1983
DRILLING METHOD 3" SPLIT SPOON	WATER LEVEL Dry
SURFACE ELEVATION 922.8'	DATE MEASURED

DEPTH (FT)	SAMPLE NO.	SAMPLE	REC (FT.)	BLOWS (6-INCH)	DESCRIPTION	WC %	LL %	PL %
	1-6	X	1.2	3-17-15	Brown and gray, moist, silty CLAY (CL) with sand, slag, wood, cinders and rock fragments, FILL			
	7-12	X	1.3	3-7-8				
5	13-18	X	1.1	3-9-9				
	19-26	X	1.0	3-5-5	. . . oil seeping from sample			
10	27-32	X	1.0	3-4-6				
	33-38	X	1.2	3-4-11	. . . oil seeping from sample			
15	39-48	X	1.2	10-12-10				
	49-54	X	1.1	9-7-7	Brown, moist, silty CLAY (CL)			
20	55-60	X	1.4	6-15-27	Gray, moist, silty CLAY (CL)			
	61-70	X	1.0	59-116	Brown and gray, moist, silty CLAY (CL) DECOMPOSED SHALE			
25	71-76	X	1.2	49-80-50/.2				
					Termination depth at 26.5 ft.			
30								

LOG OF BORING SN012

LASKIN-POPLAR OIL, JEFFERSON, OHIO

DRAWN BY: REM	CHECKED BY: KCM	PROJECT NO: 83C091B	DATE: 10-16-84

Attachment 2
FIELDWORK MEMORANDUM A-1

GENERAL NOTES

DRILLING & SAMPLING SYMBOLS:

SS	:	Split Spoon - 1 3/8" I.D., 2" O.D. Unless otherwise noted	OS	:	Osterberg Sampler - 3" Shelby Tube
ST	:	Shelby Tube - 2" O.D., Unless otherwise noted	HS	:	Hollow Stem Auger
PA	:	Power Auger	WS	:	Wash Sample
DB	:	Diamond Bit - NX, BX, AX	FT	:	Fish Tail
AS	:	Auger Sample	RB	:	Rock Bit
JS	:	Jar Sample	BS	:	Bulk Sample
VS	:	Vane Shear	PM	:	Pressuremeter Test, In-Situ
			GS	:	Giddings Sampler

Standard "N" Penetration: Blows per foot of a 140 pound hammer falling 30 inches on a 2 inch O.D. split spoon sampler, except where otherwise noted.

WATER LEVEL MEASUREMENT SYMBOLS:

WL	:	Water Level	WCI	:	Wet Cave In
WS	:	While Sampling	DCI	:	Dry Cave In
WD	:	While Drilling	BCR	:	Before Casing Removal
AB	:	After Boring	ACR	:	After Casing Removal

Water levels indicated on the boring logs are the levels measured in the boring at the times indicated. In pervious soils, the indicated elevations are considered reliable groundwater levels. In impervious soils, the accurate determination of ground water elevations may not be possible, even after several days of observations; additional evidence of ground water elevations must be sought.

GRADATION DESCRIPTION & TERMINOLOGY:

Coarse Grained or Granular Soils have more than 50% of their dry weight retained on a #200 sieve; they are described as: boulders, cobbles, gravel or sand. Fine Grained soils have less than 50% of their dry weight retained on a #200 sieve; they are described as: clays or clayey silts if they are cohesive and silts if they are non-cohesive. In addition to gradation, granular soils are defined on the basis of their relative in-place density and fine grained soils on the basis of their strength or consistency and their plasticity.

Major Component Of Sample	Size Range	Descriptive Term Of Components Also Present in Sample	Percent Of Dry Weight
Boulders	Over 8 in. (200 mm)	Trace	1 - 9
Cobbles	8 inches to 3 inches (200 mm to 75 mm)	Little	10 - 19
Gravel	3 inches to #4 sieve (75 mm to 4.76 mm)	Some	20 - 34
Sand	#4 to #200 sieve (4.76 mm to 0.074 mm)	And	35 - 50
Silt	Passing #200 sieve (0.074 mm to 0.005 mm)		
Clay	Smaller than 0.005 mm		

CONSISTENCY OF COHESIVE SOILS:

Unconfined Compressive Strength, Qu, tsf	Consistency
< 0.25	Very Soft
0.25 - 0.49	Soft
0.50 - 0.99	Medium (Firm)
1.00 - 1.99	Stiff
2.00 - 3.99	Very Stiff
4.00 - 8.00	Hard
> 8.00	Very Hard

RELATIVE DENSITY OF GRANULAR SOILS:

N - Blows per ft.	Relative Density
0 - 3	Very Loose
4 - 9	Loose
10 - 29	Medium Dense
30 - 49	Dense
50 - 80	Very Dense
80+	Extremely Dense

LOG OF BORING NO. B-1

OWNER	ARCHITECT-ENGINEER
Poplar Oil Company	U.S. Environmental Protection Agency
SITE	**PROJECT NAME**
Jefferson, Ohio	Soil and Ground Water Study

SURFACE ELEVATION 903.0

UNCONFINED COMPRESSIVE STRENGTH TONS/FT² (1, 2, 3, 4, 5) — PLASTIC LIMIT % (X) — WATER CONTENT % (●) — LIQUID LIMIT % (△) — STANDARD PENETRATION BLOWS/FT (⊗) (10, 20, 30, 40, 50)

Depth	Sample No.	Type Sample	Description of Material	Std. Penetration (blows/ft)
	1	SS	Topsoil	
	1A	SS	Clay: brown, some gray-silty-trace sand-firm-(CL)	10
	2	SS	Clay: brown-silty-trace small gravel & rock fragments-firm-(CL)	24
5.0	3	SS		17
	4	SS		50
10.0	5	SS	Shale: brown & gray-silty-decomposed soft	88/.3
	6	SS	Shale: brown & gray-silty clayey soft	67/.5
	7	SS	Shale: gray-silty soft	100/.3
	8	SS		100/.3

Depth	Run	Type	Description of Material	Core Run	Recovery	RQD
20.0	Run 1	NX	Shale: gray, some brown stains, thinly bedded-moderately hard-fine texture-with a few seams of sandy shale	1	6.9' / 7.6'	24%
25.0	Run 1	NX	Shale: gray-thinly bedded-sandy-moderately hard-fine texture-some scattered fractures			
30.0	Run 2	NX		2	3.7' / 7.2'	0%
35.0						
40.0	Run 3	NX		3	9.9' / 10.0'	60%
42.8						

End of Boring @ 42.8'.

Boring drilled with solid auger to 17.5'.

Wash water used below 17.5.

WATER LEVEL OBSERVATIONS		
W.L. 9.0 BCR		
W.L.	BCR	ACR
W.L.		

SOIL TESTING SERVICES
OF OHIO, INC.
23440 Commerce Park Road
Beachwood, Ohio 44122

BORING STARTED			3/12/81
BORING COMPLETED			3/13/81
RIG	10	FOREMAN	MRL
DRAWN	EGD	APPROVED	KCM
JOB #	10093	SHEET	1 of 1

The stratification lines represent the approximate boundary between soil types and the transition may be gradual

88831779-0

LOG OF BORING NO. B-2

OWNER	ARCHITECT-ENGINEER
Poplar Oil Company	U. S. Environmental Protection Agency
SITE	PROJECT NAME
Jefferson, Ohio	Soil and Ground Water Study

SURFACE ELEVATION 908.6

Sample No.	Type Sample	Description of Material	Standard Penetration (Blows/ft)
1	SS	Clay: brown-silty-little sand & gravel soft-(CL) (Possible fill)	9
2	SS		8
3	SS	Clay: brown, some gray-silty-trace small gravel-rock fragments-trace roots-firm-(CL) (Possible fill)	17
4	SS	Clay: dark brown-sandy-some organic material, few pieces coal-trace roots-soft-(CL) (Possible fill)	6
5	SS	Peat: dark brown-seams of silty clay-(OL)	5
6	SS	Clay: brown, some gray-silty trace rock fragments-firm-(CL)	23
7	SS		31
8	SS	Shale: brown & gray-soft-slightly weathered	100/2
9	SS		90
10	SS		84/5

Run	Type	Description of Material	Core Run	Recovery	RQD
1	NX	Shale: gray, few clay seams-thinly bedded-sandy-moderately hard-fine texture-unweathered	1	7.7' / 10.0'	0%
1	NX	Shale: gray-thinly bedded moderately hard-fine texture			
2	NX	Shale: gray-thinly bedded-sandy moderately hard-fine texture-solid	2	9.8' / 10.0'	0%
2	NX	Shale: gray-thinly bedded-moderately hard-fine texture-solid			

Depth marks: 10.0, 15.0, 20.0, 25.0, 30.0, 35.0, 40.0, 44.5

End of Boring @ 44.5'.

Boring drilled with solid auger to 20.0'.
Wash water used below 20.0.'

WATER LEVEL OBSERVATIONS		
W.L.	9.4 WS	
W.L.	12.0 BCR	ACR
W.L.		

SOIL TESTING SERVICES OF OHIO, INC.
23400 Commerce Park Road
Beachwood, Ohio 44122

BORING STARTED	3/16/81		
BORING COMPLETED	3/17/81		
RIG	10	FOREMAN	MRL
DRAWN	EGD	APPROVED	KCM
JOB #	10093	SHEET	1 of 1

The stratification lines represent the approximate boundary between soil types and the transition may be gradual

88831779-0

LOG OF BORING NO. B-3

OWNER: Poplar Oil Company	ARCHITECT-ENGINEER: U. S. Environmental Protection Agency
SITE: Jefferson, Ohio	PROJECT NAME: Soil and Ground Water Study

SURFACE ELEVATION 925.5 Adjusted El. 915.5*

Depth	Sample No.	Type Sample	Description of Material	SPT (blows/ft)
	1	SS	Topsoil	
	1A	SS	Clay: brown & gray-silty-trace organic material-soft-(CL)	9
	2	SS		8
5.0	3	SS	Clay: brown & gray-silty-some topsoil-soft-(CL)	8
	4	SS	Clay: brown & gray-silty-trace of rock fragments-firm-(CL)	19
10.0	5	SS		28
	6	SS	Clay: brown-silty-trace of small gravel & rock fragment-very stiff-(CL)	72
15.0	7	SS	Silt: brown & gray-clayey-dense-(ML)	32
	8	SS	Silt: gray-clayey-trace of rock fragments-very dense-(ML)	62
20.0	9	SS	Shale: gray-decomposed	100/.4

Depth	Sample No.	Type Sample	Description of Material	Core Run	Recovery	RQD
25.0	1	NX	Shale: gray-few small clay seams-thinly bedded-silty-moderately hard-slightly weathered	1	6.9'/7.5'	0%
30.0 / 35.0 / 40.0	2	NX	Shale: gray-massive-sandy-hard-dense texture-unweathered	2	9.7'/10.0'	47%
45.0 / 50.0	3	NX	End of Boring @ 50.0'. Boring drilled with solid auger to 20.0'. Wash water used below 20.0'.	3	10.0'/10.0'	86%

WATER LEVEL OBSERVATIONS

WL			
WL	12.0	BCR	ACR
WL			

SOIL TESTING SERVICES OF OHIO, INC.
23440 Commerce Park Road
Beachwood, Ohio 44122

BORING STARTED			3/10/81
BORING COMPLETED			3/11/81
RIG	10	FOREMAN	MRL
DRAWN	EGD	APPROVED	KCM
JOB #	10093	SHEET	1 of 1

The stratification lines represent the approximate boundary between soil types and the transition may be gradual

88531779-0

*Reported surface elevation adjusted to 915.5 ft MSL based on LPO topographic map data (Plate 1)

Fieldwork Memorandum A-2
ONSITE SAMPLING SURFACE SOIL

GLT777/24-2

CH2M HILL

FIELD WORK MEMORANDUM A-2

TO: Donna Twickler/Remedial Project Manager, U.S. EPA

FROM: Randy Videkovich/Site Manager, CH2M HILL

RE: Onsite Sampling Surface Soil
Laskin Poplar Oil Site

PREPARED BY: Woodward-Clyde Consultants

DATE: August 20, 1986

REVISED BY: CH2M HILL, February 25, 1988

This memorandum was prepared by Woodward-Clyde Consultants for the Phase I RI under REM/FIT Contract No. 68-01-6692, Work Assignment 32.5L03.0. It has subsequently been revised by CH2M HILL during the Phase II RI/FS. Revisions are limited to format changes.

GENERAL

To identify the level of soil contamination at selected locations on the Laskin Poplar Oil site, five surface soil samples were obtained. Sample locations were numbered SN013 through SN017 in accordance with the Sample Plan designations. Sample locations (see Figure A-2-1) were selected during the site reconnaissance on November 14, 1983. Sample SN013 was obtained in the boiler house in the vicinity of Boiler No. 2 (see Figure A-2-2). Sample locations SN014 through SN017 were selected on the basis of visual observations of oil stains near pits, tanks, and the retention pond. These locations were assumed to be representative of areas where contamination was likely to have occurred. Onsite surface soil samples were collected on December 1 and 2, 1983.

Four additional onsite locations (Figure A-2-1) were sampled on June 6, 1985, for chlorinated dioxin/furan testing. Samples SN018 and SN019 were collected near the boiler/stack area, SN020 in the tank area, and SN021 north of the retention pond. These locations were chosen to be near the stack, near the stack cleanout port, and in oil stained areas in the tank and retention pond areas.

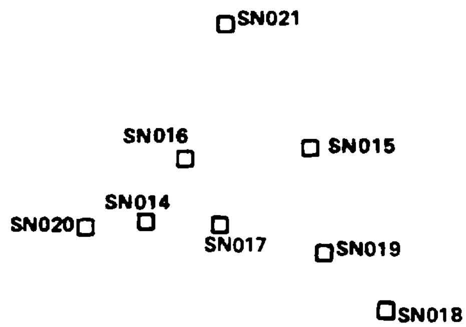
SAMPLING PROCEDURE

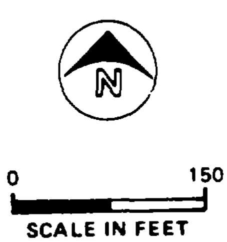
Onsite surface soil samples were obtained by loosening the soil surface and digging a 4- to 6-inch-deep hole in the soil. A decontaminated stainless steel spoon was used for digging and thoroughly mixing the soil in place. Gravel and any miscellaneous large pieces of fill material encountered were removed, and samples were placed in 8-ounce glass containers. After sampling, any remaining soil was placed back into the hole. The sample obtained from the boiler house floor (SN013) was from an area where the ground surface was very hard. As a result, the sample was obtained from a shallower hole (2- to 4-inch-deep) with a larger surface area.

At location SN016, duplicate and blank samples were prepared. Duplicate samples were obtained by the procedure described above. Blank samples were prepared by filling sample jars with diatomaceous earth using a decontaminated stainless steel spoon. Seven onsite surface soil samples were sent to the Contract Laboratory Program for HSL organic and inorganic constituent analyses: five investigative samples, one duplicate, and one blank.

Duplicate samples were collected at dioxin/furan sampling locations SN018 and SN019. Six samples, including the two duplicates, were sent to the Contract Laboratory Program for chlorinated dioxin/furan testing under Special Analytical Services.

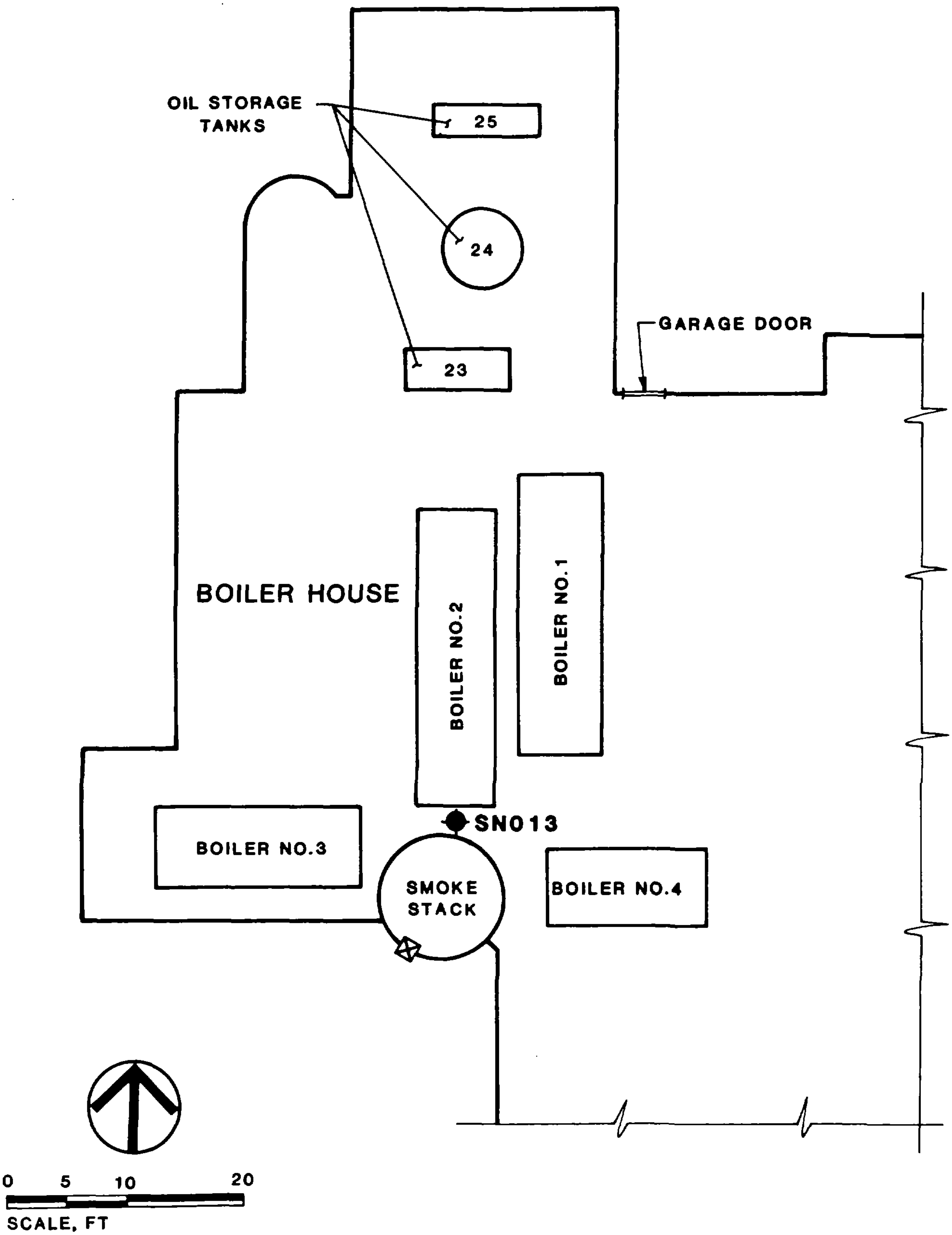
Sampling equipment used during the field investigation was decontaminated before each sampling event. Decontamination consisted of a detergent wash (sodium carbonate and trisodium phosphate) and distilled water rinses. Equipment was allowed to air dry. During wet weather conditions, however, the sampling equipment was wiped dry with paper towels.





NOTE: SAMPLE LOCATIONS ARE APPROXIMATE.

FIGURE A-2-1
SURFACE SOIL
SAMPLING LOCATIONS
LASKIN POPLAR OIL



NOTE: BOILER AND TANK LOCATIONS AND DIMENSIONS ARE APPROXIMATE

FIGURE A-2-2
BOILER HOUSE SAMPLE LOCATION PLAN
LASKIN POPLAR OIL

Fieldwork Memorandum A-3
GROUNDWATER MONITORING WELL INSTALLATION

FIELDWORK MEMORANDUM A-3

TO: Donna Twickler/Remedial Project Manager, U.S. EPA

FROM: Randy Videkovich/Site Manager, CH2M HILL

RE: Groundwater Monitoring Well Installation
Laskin Poplar Oil Site

PREPARED BY: Woodward-Clyde Consultants

DATE: August 20, 1986

REVISED BY: CH2M HILL, February 25, 1988

This memorandum was prepared by Woodward-Clyde Consultants for the Phase I RI under REM/FIT Contract No. 68-01-6692, Work Assignment 32.5L03.0. It has subsequently been revised by CH2M HILL during the Phase II RI/FS. Revisions are limited to format changes.

GENERAL

Five groundwater monitoring wells (see Figure A-3-1) were installed between October 5 and October 11, 1983, and on November 15, 1983, in Borings SN001 through SN005. After installation, the monitoring wells were surveyed using stadia surveying techniques. Elevations were determined at the top of each well and on the ground surface next to each well. Elevations were referenced to an assumed base elevation of 100.0 feet set on a fire hydrant located adjacent to the site along the west side of Poplar Street. The elevation on the hydrant was subsequently referenced to USGS elevations.

MONITORING WELL INSTALLATION

Following completion of a soil boring, the depth of the boring was measured and noted in the field book. Except for the well installed in Boring SN003, monitoring wells were installed to the termination depth of the borings. In Boring SN003, the borehole was backfilled with 4.5 feet of sand to 22.5 feet below the ground surface and then the monitoring well was installed. The well screen was installed to bracket the soil/rock interface at a depth of 21 feet. Monitoring wells were constructed of 2-inch-diameter, flush-joint, threaded PVC well screens, 5 feet long with 0.010-inch wide slots. The riser pipe above the well screen was also 2-inch-diameter, flush-joint, threaded PVC.

A sand pack was placed in the annulus between the borehole and the PVC pipe to approximately 2 feet above the top of the screen. Approximately 1 foot of bentonite pellets was placed on top of the sand pack as a seal. If the bentonite seal was placed above the water table, small amounts of water were poured into the borehole to hydrate the pellets. The remainder of the annular space was backfilled with a cement-bentonite grout to the ground surface. A steel protector pipe with a hinged locking cap was placed in the grout such that the top of the steel casing was slightly above the top of the PVC riser pipe. The details of the monitoring well construction and typical construction details are shown in Attachment 1.

MONITORING WELL DEVELOPMENT

Development of the groundwater monitoring wells was conducted on October 12, 1983, for Wells GW001 through GW004 and on December 1, 1983, for Well GW005. Development consisted of bailing each well with a stainless steel bailer raised and lowered in the well with a nylon rope. Approximately 6 to 7.5 gallons of water was bailed from each well except GW003, which was dry.

Sampling equipment used during the field investigation was decontaminated before each sampling event. Decontamination consisted of a detergent wash (sodium carbonate and trisodium phosphate) and distilled water rinses. Equipment was allowed to air dry. During wet weather conditions, however, the sampling equipment was wiped dry with paper towels.

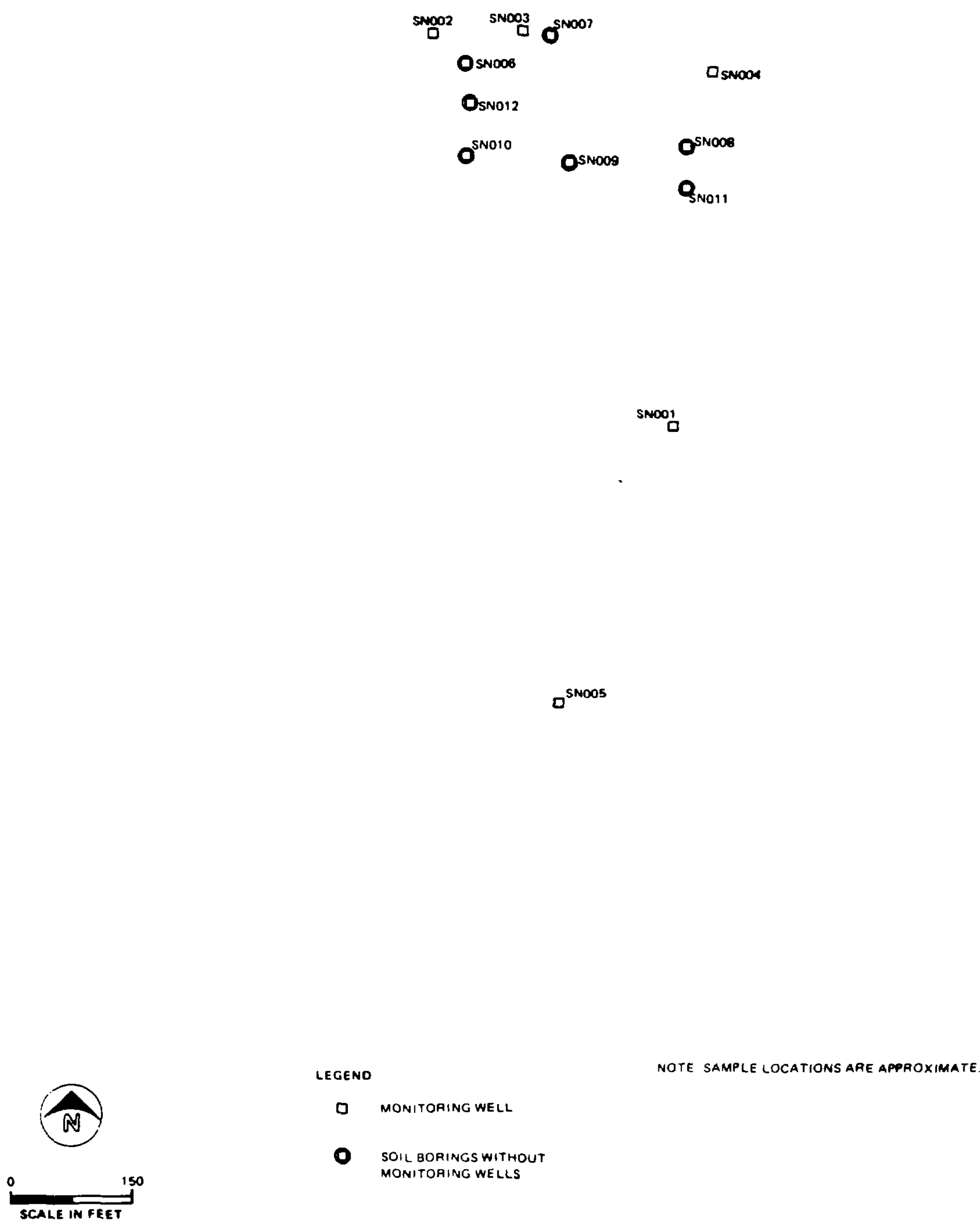
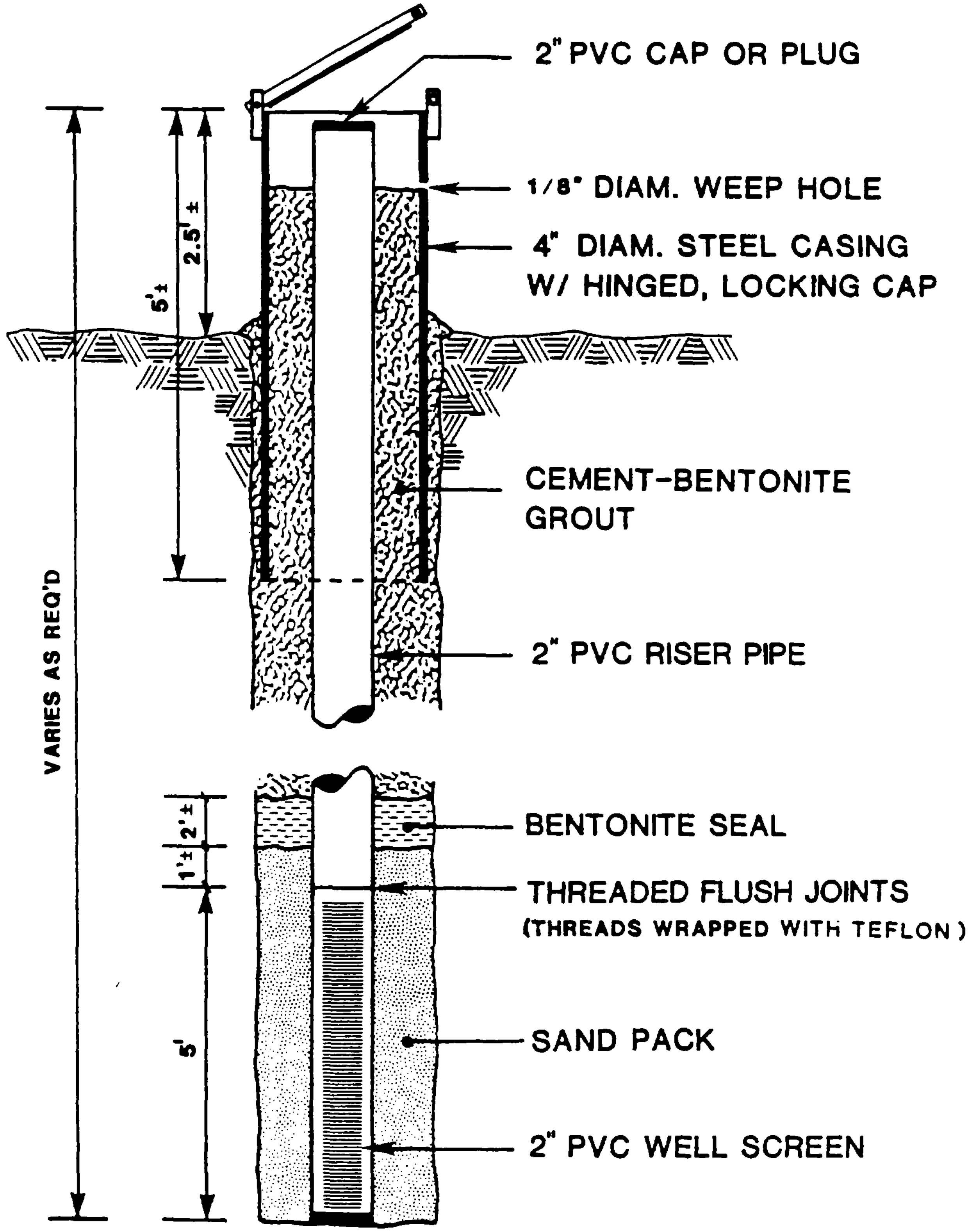
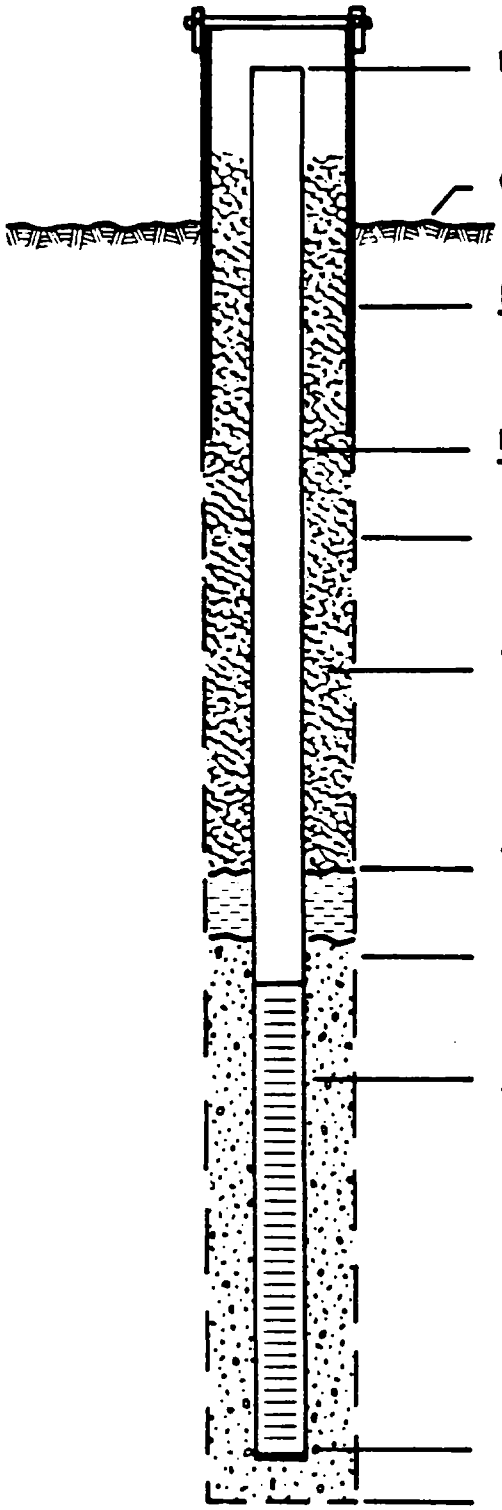


FIGURE A-3-1
MONITORING WELL LOCATIONS
LASKIN POPLAR OIL

Attachment 1
FIELDWORK MEMORANDUM A-3



TYPICAL MONITORING WELL
CONSTRUCTION DESIGN
LASKIN-POPLAR OIL, JEFFERSON, OHIO



Elevation of top of riser pipe 919.91 ft MSL

Ground Elevation 918.4 ft MSL

I.D. of surface casing 4-inch
Type of surface casing Steel
with locking, hinged cap

I.D. of riser pipe 2-inch
Type of riser pipe PVC

Diameter of borehole 10-inch

Type of backfill Cement-Bentonite

Type of seal Bentonite pellets
Depth to top of seal 19 Ft

Depth to top of sand pack 20 Ft

Depth to top of screen 22.5 Ft
Type of screened section PVC
.010-inch slot

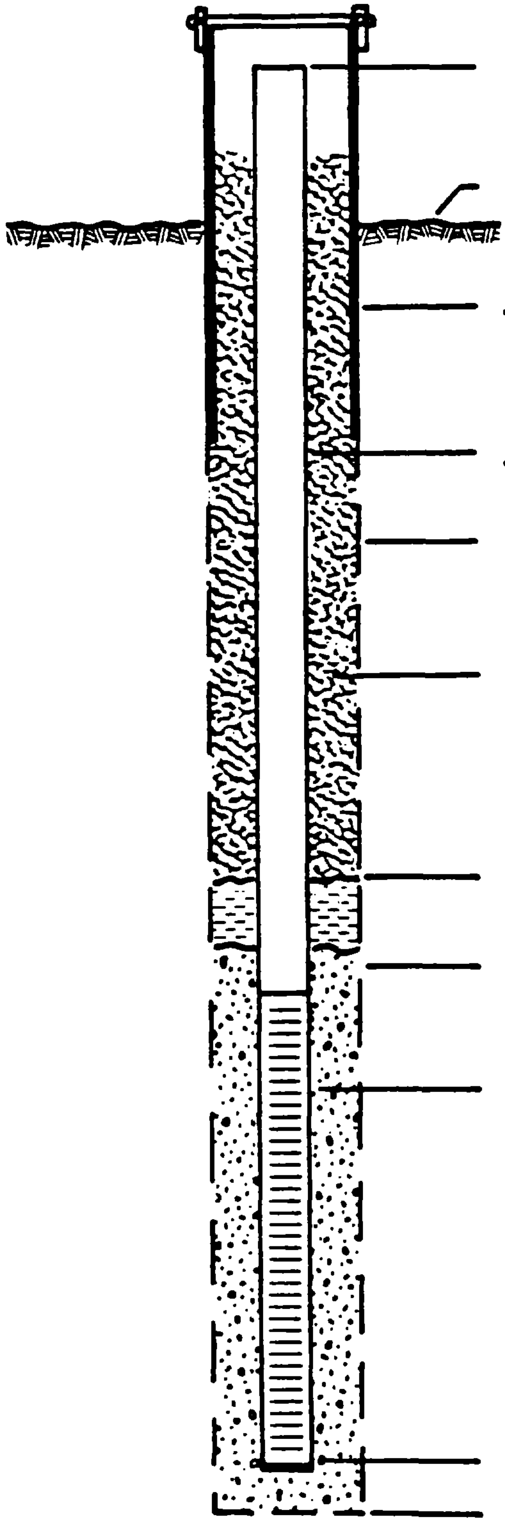
I.D. of screened section 2-inch

Depth to bottom of well 27.5 Ft

Depth of borehole 27.5 Ft.

REPORT OF MONITORING WELL 1 (SN001)

LASKIN-POPLAR OIL, JEFFERSON, OHIO



Elevation of top of riser pipe 904.98 ft MSL

Ground Elevation 903.9 ft MSL

I.D. of surface casing 4-inch
Type of surface casing Steel
with locking, hinged cap

I.D. of riser pipe 2-inch
Type of riser pipe PVC

Diameter of borehole 10-inch

Type of backfill Cement-Bentonite

Type of seal Bentonite pellets
Depth to top of seal 16 Ft

Depth to top of sand pack 17 Ft

Depth to top of screen 19 Ft
Type of screened section PVC
0.010-inch slot

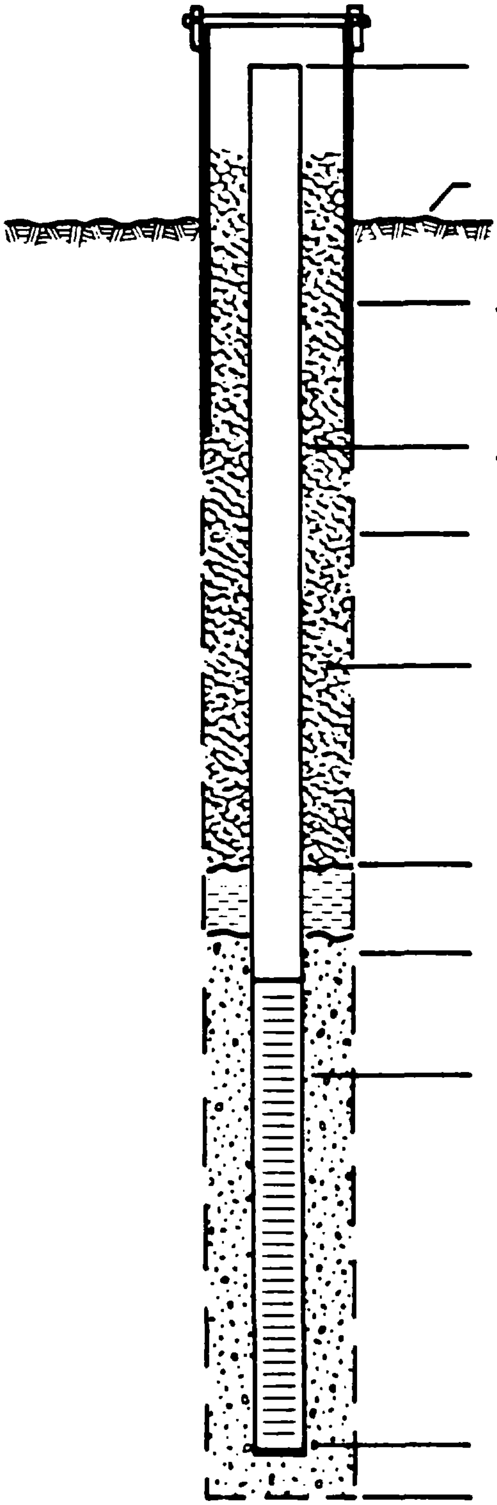
I.D. of screened section 2-inch

Depth to bottom of well 24 Ft

Depth of borehole 24 Ft

REPORT OF MONITORING WELL 2 (SN002)

LASKIN-POPLAR OIL, JEFFERSON, OHIO



Elevation of top of riser pipe 908.50 ft MSL

Ground Elevation 905.9 ft MSL

I.D. of surface casing 4-inch

Type of surface casing Steel with locking, hinged cap

I.D. of riser pipe 2-inch

Type of riser pipe PVC

Diameter of borehole 10-inch

Type of backfill Cement-Bentonite

Type of seal Bentonite pellets

Depth to top of seal 14.5 Ft

Depth to top of sand pack 15.5 Ft

Depth to top of screen 17.5 Ft

Type of screened section PVC 0.010-inch slot

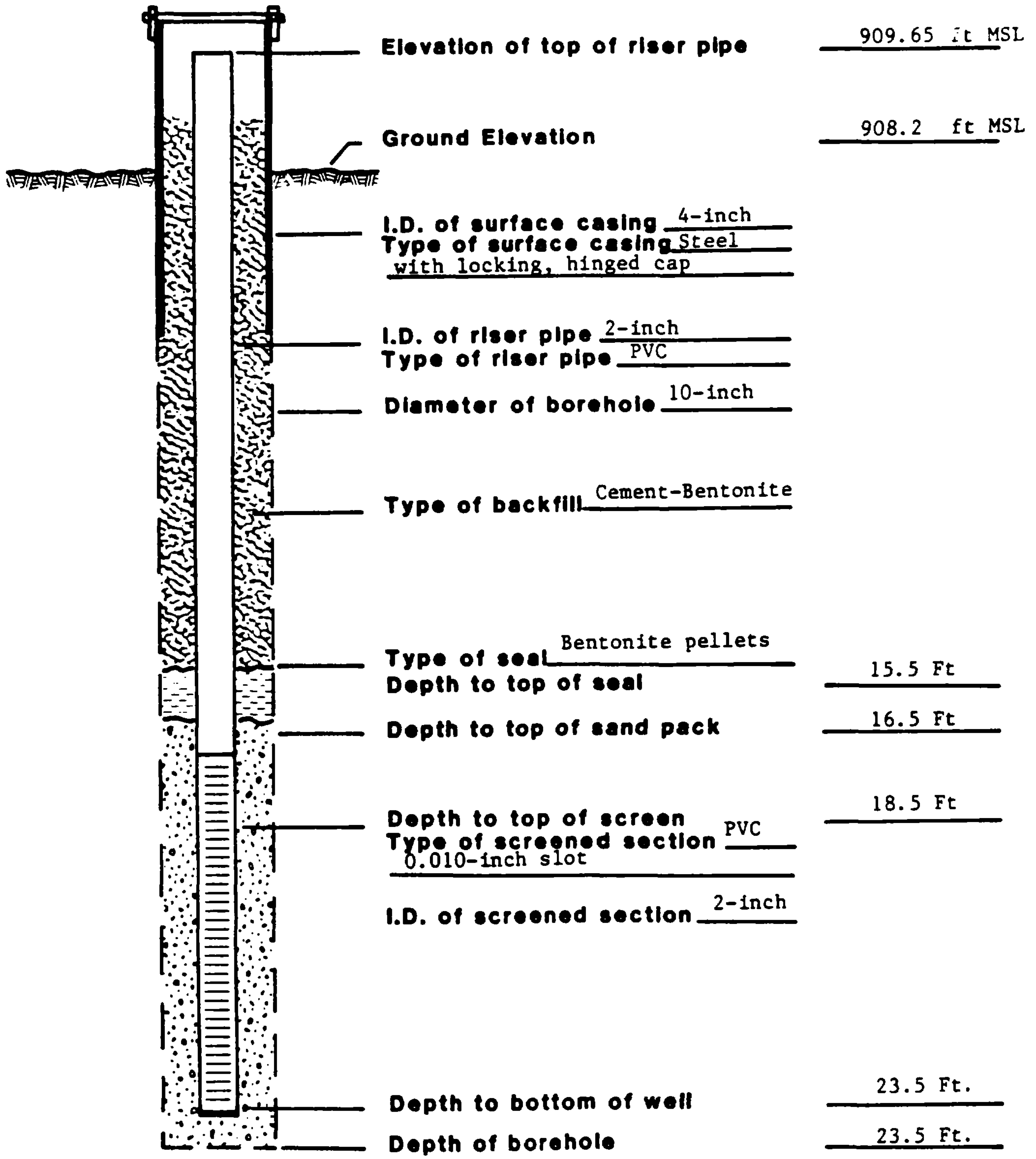
I.D. of screened section 2-inch

Depth to bottom of well 22.5 Ft

Depth of borehole 27 Ft

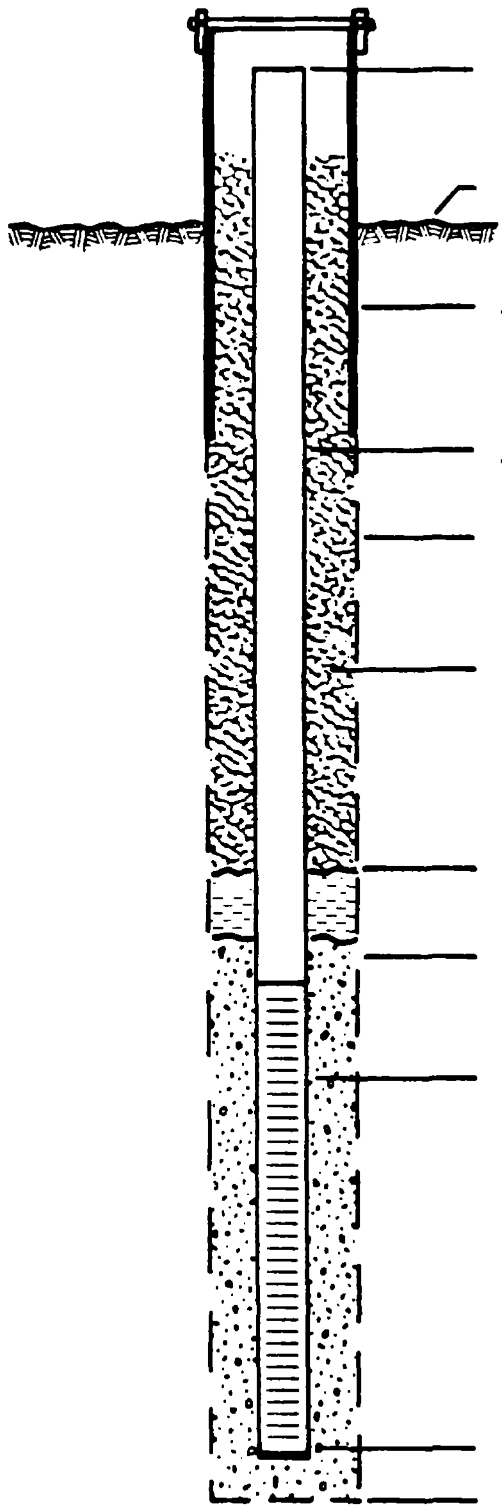
REPORT OF MONITORING WELL 3 (SN003)

LASKIN-POPLAR OIL, JEFFERSON, OHIO



REPORT OF MONITORING WELL 4 (SN004)

LASKIN-POPLAR OIL, JEFFERSON, OHIO



Elevation of top of riser pipe: 917.62 ft MSL

Ground Elevation: 915.4 ft MSL

I.D. of surface casing: 4-inch
Type of surface casing: Steel
with locking, hinged cap

I.D. of riser pipe: 2-inch
Type of riser pipe: PVC

Diameter of borehole: 10-inch

Type of backfill: Cement-Bentonite

Type of seal: Bentonite pellets
Depth to top of seal: 20 Ft

Depth to top of sand pack: 21 Ft

Depth to top of screen: 23 Ft
Type of screened section: PVC
0.010-inch slot

I.D. of screened section: 2-inch

Depth to bottom of well: 28 Ft

Depth of borehole: 28 Ft.

REPORT OF MONITORING WELL 5 (SN005)

LASKIN-POPLAR OIL, JEFFERSON, OHIO

Fieldwork Memorandum A-4
OFFSITE SOIL SAMPLING

FIELDWORK MEMORANDUM A-4

TO: Donna Twickler/Remedial Project Manager, U.S. EPA

FROM: Randy Videkovich/Site Manager, CH2M HILL

RE: Offsite Soil Sampling
Laskin Poplar Oil Site

PREPARED BY: Woodward-Clyde Consultants

DATE: August 20, 1986

REVISED BY: CH2M HILL, February 25, 1988

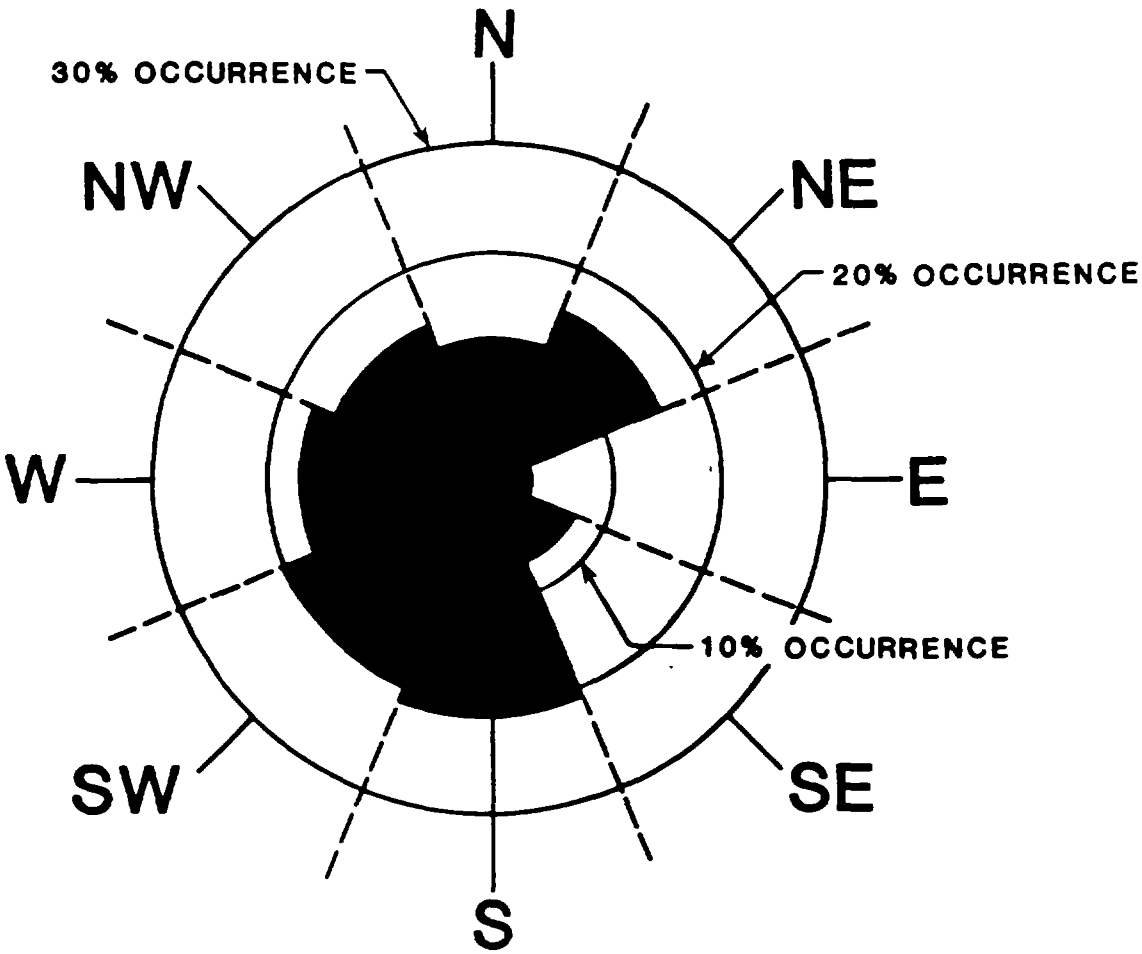
This memorandum was prepared by Woodward-Clyde Consultants for the Phase I RI under REM/FIT Contract No. 69-01-6692, Work Assignment 32.5L03.0. It has subsequently been revised by CH2M HILL during the Phase II RI/FS. Revisions are limited to format changes.

GENERAL

Sixteen locations were sampled on November 18, 29, and 30, 1983, to identify potential offsite HSL organic and inorganic constituent soil contamination. On November 6, 1984, 4 of the 16 locations and 3 new locations were sampled for chlorodibenzo-p-dioxin and chlorodibenzofuran testing. Tentative sample locations were selected based on the results of the air dispersion model study described in the attached Technical Memorandum. A wind rose of regional annual wind direction patterns is presented on Figure A-4-1.

The air dispersion study indicated that the maximum impact from operation of the boilers would be north and northeast of the site at a distance of 0.7 to 0.8 km (Figure A-4-2). Tentative sample locations were selected to be representative of the maximum impact areas and areas near the site of perceived public concern. The 1983 sample locations were selected during an onsite meeting between U.S. EPA and Ohio EPA on November 14, 1983. The 1984 sample locations were selected during phone conversations with U.S. EPA personnel in October 1984.

The rationale for the selection of offsite surface soil sample locations is summarized below. Sample locations SF001

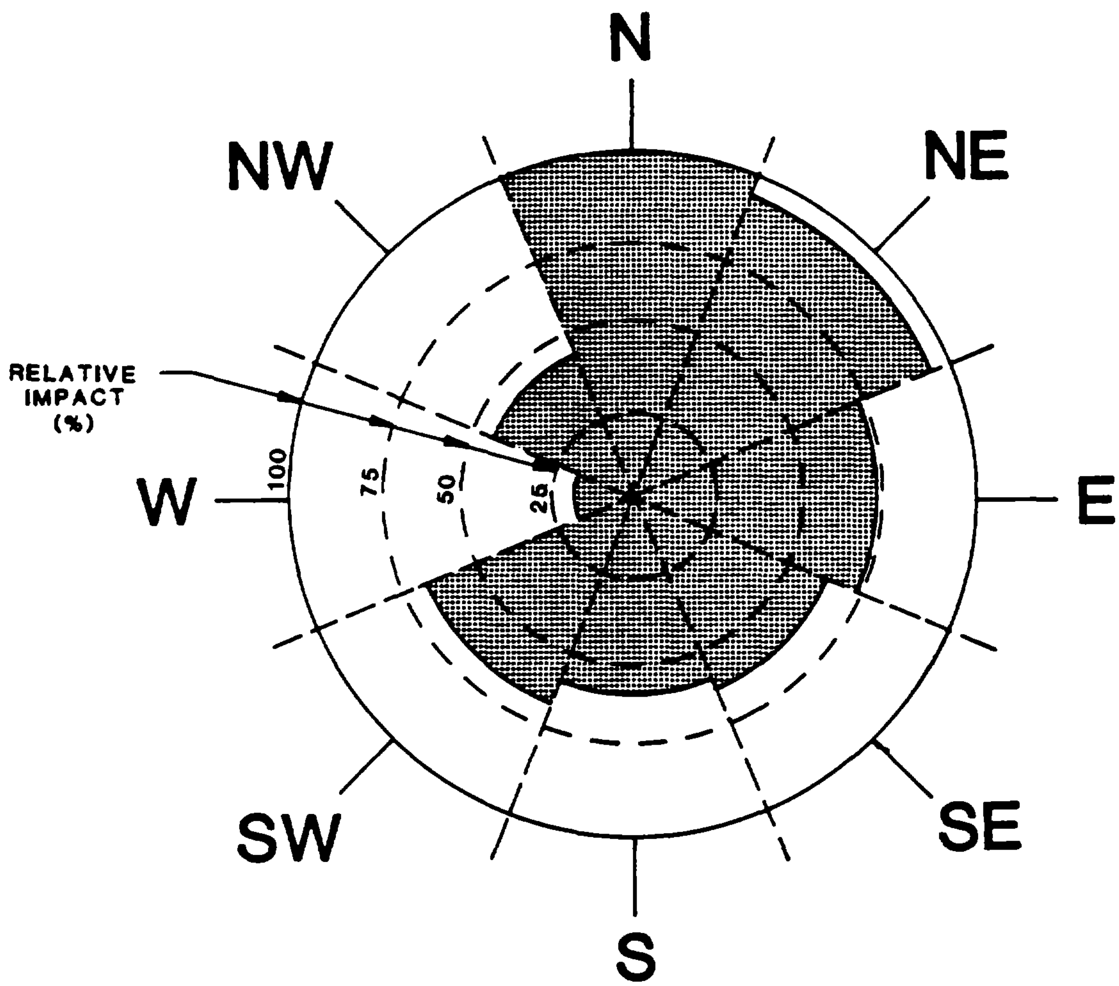


WIND DATA AVERAGE OF 11-YEAR
PERIOD FOR CLEVELAND, OHIO
SOURCE: U.S. COAST GUARD - ASHTABULA, OHIO

AVERAGE YEARLY WIND DIRECTION

NOTE: WIND BLOWS FROM INDICATED DIRECTION.

FIGURE A-4-1
WIND ROSE
LASKIN-POPLAR OIL, JEFFERSON, OHIO



NOTE: IMPACTS PER QUADRANT ARE EXPRESSED RELATIVE TO THE MAXIMUM IMPACT IN THE NORTHERN QUADRANT.

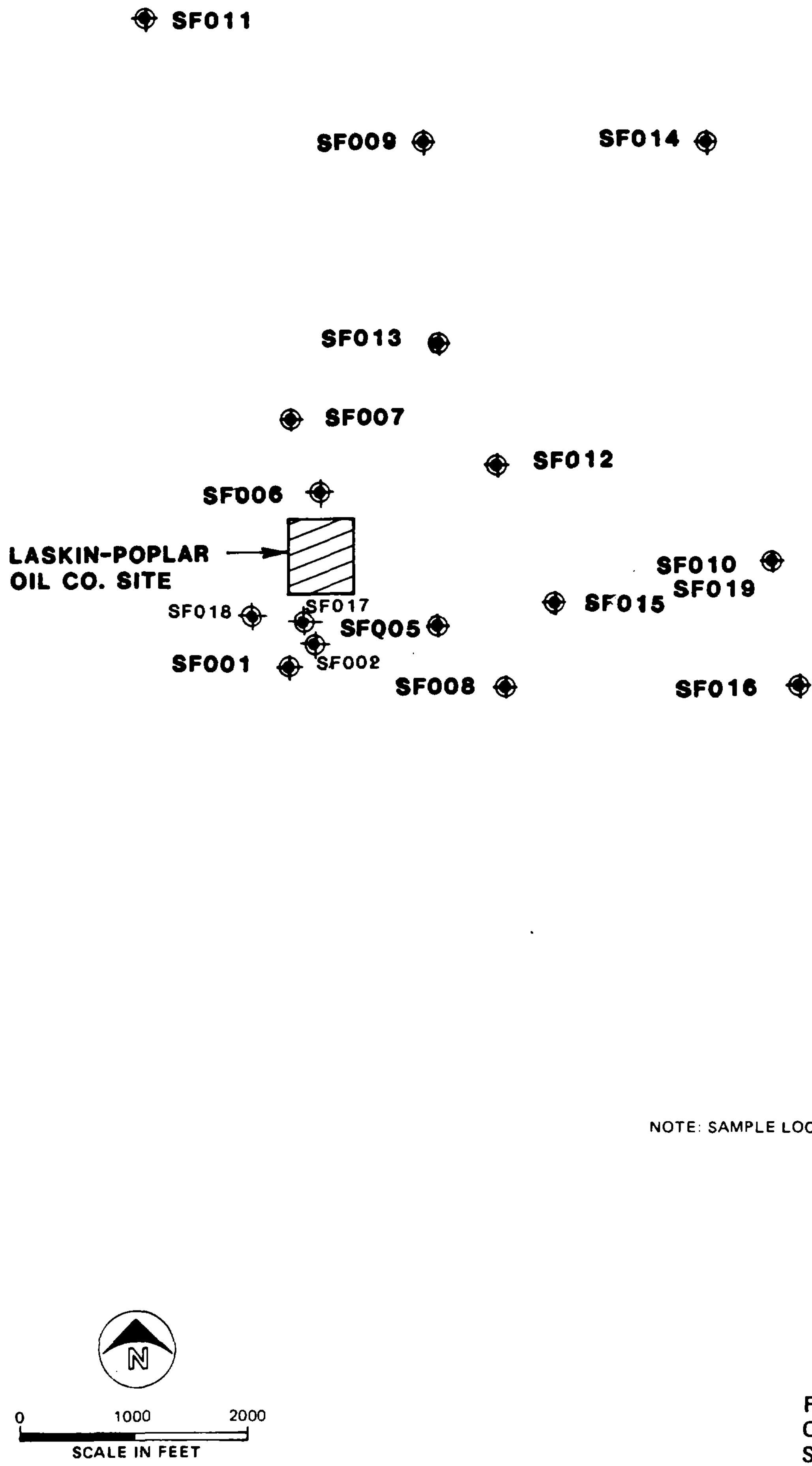
FIGURE A-4-2
POTENTIAL IMPACT AREAS
FROM LPO BOILER OPERATIONS
LASKIN-POPLAR OIL, JEFFERSON, OHIO

through SF007 and SF010 were designated by U.S. EPA and OEPA.

- SF001 and SF002--Located in baseball diamonds used by general public.
- SF003 and SF004--Located in grass area on Laskin property, but outside site boundary (U.S. EPA fence).
- SF005--Located in Ashtabula County Fairground
- SF006 and SF007--Located on private property north of the site on Ohio Route 307.
- SF010--Located near Ashtabula County garage in Village of Jefferson.
- SF008, SF009, and SF011 through SF019 --Located in the north, northeast, and east quadrants at 0.7 to 1.5 km from the site. Based on results of air dispersion model (Figure A-4-2).

The 19 sample locations are shown on Figure A-4-3. The sample locations were referenced to existing ground surface features, house locations, and streets. Sample locations were numbered in accordance with Sampling Plan designations SF001 through SF019. Locations SF001 through SF016 were sampled in 1983 for HSL organic and inorganic constituent testing. Locations SF005, SF006, SF013, SF014, SF017, SF018, and SF019 were sampled in 1984 for dioxin/furan testing.

On May 30, 1985, surface soil samples were collected from six offsite locations assumed to be representative of local conditions and minimally impacted by boiler and stack operations at the Laskin Poplar Oil site. Accordingly, background soil samples were generally located about 2 miles from the site in the southern quadrants. These locations were selected during a phone conversation with Ohio EPA personnel in May 1985. The locations of the offsite surface soil samples (SF020 through SF025) are shown on Figure A-4-4. The offsite soil samples were analyzed to provide local background concentrations for use in screening the chemicals detected in non-background samples of soil, sediment, and boiler/stack residue.



NOTE: SAMPLE LOCATIONS ARE APPROXIMATE.

FIGURE A-4-3
OFFSITE SURFACE SOIL
SAMPLING LOCATIONS
LASKIN POPLAR OIL

SAMPLING PROCEDURES

Offsite soil samples were obtained by removing sod from the sampling site and digging a 4- to 6-inch-deep hole in the underlying soil. A stainless steel spoon was used for digging and to thoroughly mix the soil in place. Gravel and coarser sand-size particles were removed and the samples placed in 8-ounce glass containers. After sampling, the remaining soil was replaced in the hole and the sod replaced.

Duplicate and blank samples were obtained at locations SF002 and SF019. Duplicate samples were obtained by the procedure described above. Blank samples were prepared by pouring diatomaceous earth into a stainless steel pan, thoroughly mixing the diatomaceous earth with a spoon, and filling the sample bottles using the stainless steel spoon. Nineteen offsite surface soil samples were submitted to the Contract Laboratory Program (CLP) for HSL organic and inorganic constituent analyses. Nine offsite surface soil samples were submitted to the Special Analytical Services of CLP for chlorodibenzodioxin dioxin and chlorodibenzofuran testing.

Duplicate background samples were collected at locations SF021 and SF025 for HSL inorganic constituent analyses and at SF022 and SF024 for HSL organic constituent analyses. Blank soil samples were not required by the CLP. Eight samples, including two duplicates, were submitted to the CLP for HSL inorganic constituent analyses, and four samples, including two duplicates, were submitted for HSL organic constituent analyses.

Sampling equipment used during the field investigation was decontaminated before each sampling event. Decontamination consisted of a detergent wash (sodium carbonate and trisodium phosphate) and distilled water rinses. Equipment was allowed to air dry. During wet weather conditions, however, the sampling equipment was wiped dry with paper towels.

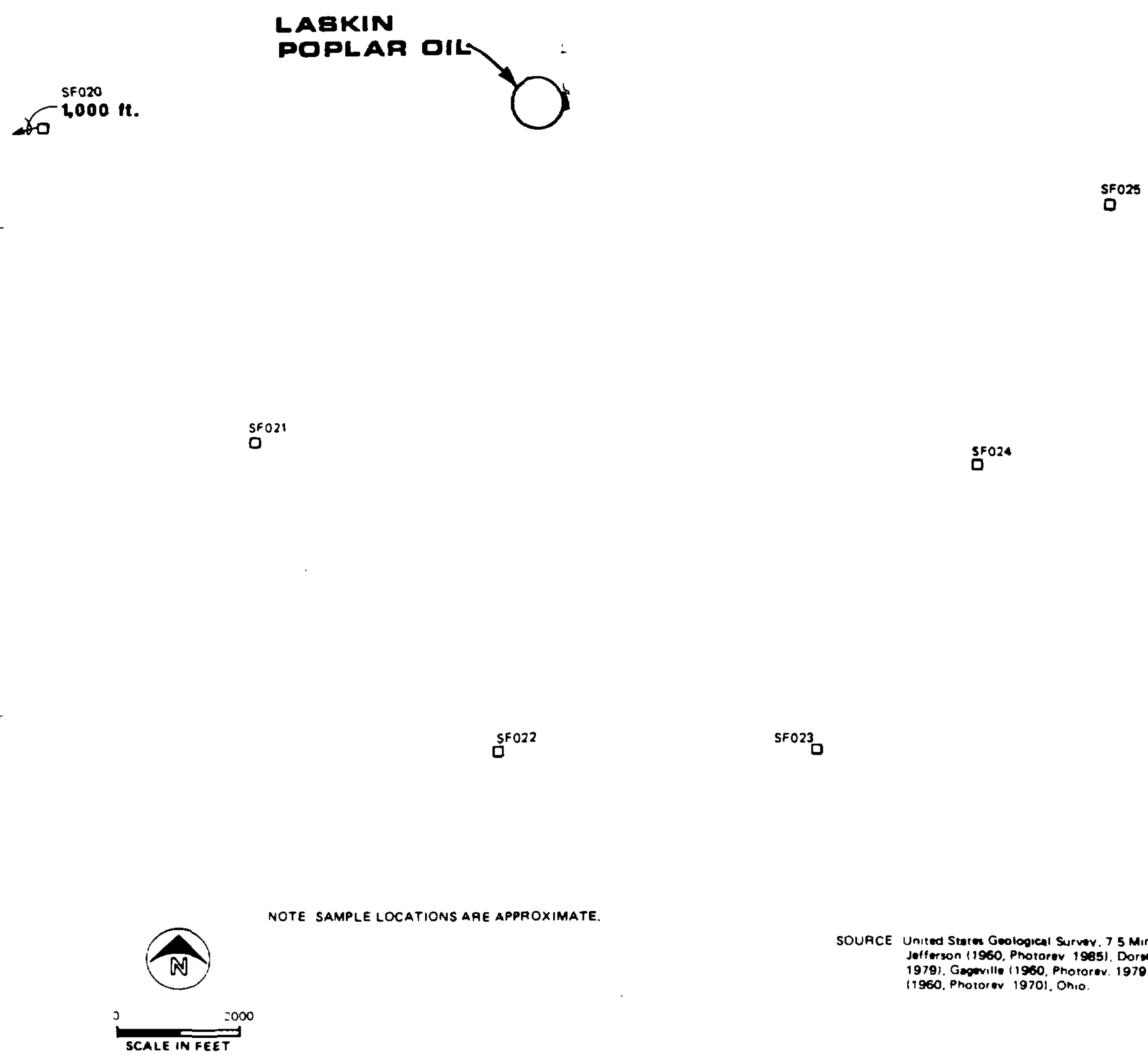
to an extension pole. The beaker was dipped into the bottom sediment and then removed from the water. Excess water was poured from the beaker and the sediment poured into a stainless steel pan. The sediment was thoroughly mixed to form a composite sample at each location. All sediment samples, whether obtained by the hand corer or from a composite sample, were placed in appropriate 8-ounce glass containers.

Duplicate samples were obtained from the freshwater pond at location SD005, in Cemetery Creek at location SD002B, and in the retention pond at location SD007. The duplicate samples were obtained in the same manner as the primary sample from that location. Blank samples were obtained for the freshwater pond location SD005. The blank was prepared by pouring diatomaceous earth into the hand corer, from the corer into a stainless steel pan, and then transferring the sample into the sample jars using a stainless steel spoon. Blank samples were also obtained from the retention pond at location SD007. The blank was prepared by pouring diatomaceous earth into the stainless steel beaker, from the beaker into a stainless steel pan, and transferring the sample into sample jars using a stainless steel spoon.

Twenty-four sediment samples were submitted to the U.S. EPA Contract Laboratory Program for HSL organic and inorganic constituent analyses. Nine sediment samples were submitted to the Contract Laboratory Program for oil and grease analyses under Special Analytical Services.

Sampling equipment used during the field investigation was decontaminated before each sampling event. Decontamination consisted of a detergent wash (sodium carbonate and trisodium phosphate) and distilled water rinses. Equipment was allowed to air dry. During wet weather conditions, however, the sampling equipment was wiped dry with paper towels.

GLT777/15



NOTE SAMPLE LOCATIONS ARE APPROXIMATE.

SOURCE United States Geological Survey, 7.5 Minute Quadrangles for Jefferson (1960, Photorev. 1985), Dorset (1959, Photorev. 1979), Gageville (1960, Photorev. 1979) and Ashtabula South (1960, Photorev. 1970), Ohio.

FIGURE A-4-4
BACKGROUND SOIL
SAMPLE LOCATIONS
LASKIN POPLAR OIL

Fieldwork Memorandum A-6
ROAD OIL SAMPLING

CH2M HILL

FIELDWORK MEMORANDUM A-6

TO: Donna Twickler/Remedial Project Manager, U.S. EPA

FROM: Randy Videkovich/Site Manager, CH2M HILL

RE: Road Oil Sampling
Laskin Poplar Oil Site

PREPARED BY: Woodward-Clyde Consultants

DATE: August 20, 1986

REVISED BY: CH2M HILL, February 25, 1988

This memorandum was prepared by Woodward-Clyde Consultants for the Phase I RI under REM/FIT Contract No. 68-01-6692, Work Assignment 32.5L03.0. It has subsequently been revised by CH2M HILL during the Phase II RI/FS. Revisions are limited to format changes.

GENERAL

On September 27 and 28, 1983, U.S. EPA records at the Region V office in Chicago, Illinois were reviewed to identify the 20 largest purchasers of oil from the Laskin Poplar Oil Company. Through contact with the firms or individuals, purchase quantities and oil use were verified. Firms that had used the purchased oil for road oiling identified roads where the oil had been spread. Ten locations were tentatively selected for sampling. The sampling locations were inspected to visually confirm previous oiling and were reviewed and approved during an onsite meeting with U.S. EPA and Ohio EPA personnel on November 14, 1983.

The 10 road oiling locations (see Figure A-6-1) were sampled on November 29 and 30, 1983. Specific sample locations are shown in Attachment 1. The sample locations were selected near existing physical features such as driveways and houses so they could easily be located.

At each sample location, two sets of samples were obtained: one from the centerline of the road and one from the shoulder. When possible, samples from the shoulder were taken in drainage features that channel runoff from the road surface. Only one sample was taken in the parking area of Grand Valley High School, Orwell, Ohio.

Road oiling sample locations and samples were numbered RD001 through RD010 in accordance with the Sample Plan.

SAMPLING PROCEDURES

Road oiling samples were obtained by loosening the soil in a section of the roadway or shoulder. The section was generally 6 to 12 inches in diameter and approximately 3 to 4 inches deep. A hammer and chisel were used to loosen the road surface. The loosened soil was thoroughly mixed in place with a stainless steel spoon. Gravel and coarser sand-size particles were removed from the sample. Because most of the sample at location RD006 was coarser sand and gravel size, nothing was removed from the sample. Each sample was placed into 8-ounce glass containers. After sampling, any remaining soil was replaced in the hole. If required, gravel was added to restore the road surface to the initial grade.

Duplicate and blank samples were obtained at locations RD002 and RD009. The blank sample was prepared at location RD002 by pouring diatomaceous earth into a stainless steel pan and filling sample jars from the pan using a stainless steel spoon. Twenty-two samples were submitted to the Contract Laboratory Program for HSL organic and inorganic constituent analyses.

Sampling equipment used during the field investigation was decontaminated before each sampling event. Decontamination consisted of a detergent wash (sodium carbonate and trisodium phosphate) and distilled water rinses. Equipment was allowed to air dry. During wet weather conditions, however, the sampling equipment was wiped dry with paper towels.

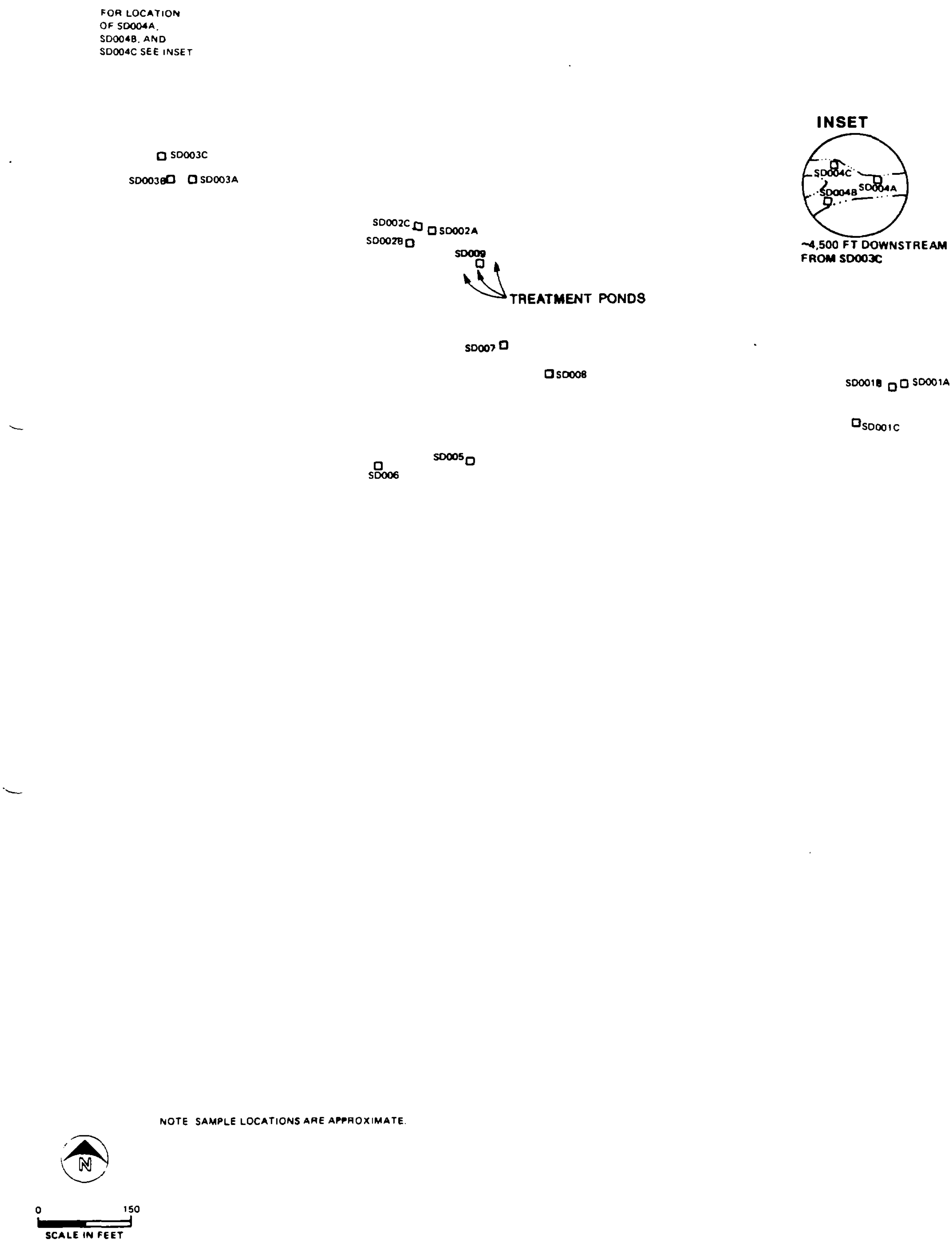


FIGURE A-5-1
SEDIMENT SAMPLING LOCATIONS
LASKIN POPLAR OIL

MEMORANDUM

CH2M HILL

TO: Bob Schilling/SEA

FROM: Don Caniparoli/PDX
Rick Kester/SEA

DATE: September 1, 1983

RE: Air Dispersion Modeling
Laskin Poplar Oil

PROJECT: W65203.00

An air quality impact analysis was performed to determine likely areas of maximum impact that resulted from the burning of waste oil at the Laskin waste oil facility. To facilitate this determination, a best estimate of the boiler operating conditions was determined, and a simple dispersion modeling analysis was performed.

From conversations with Mr. Alvin Laskin and review of state operating permits, boiler manufacturer specifications, and combustion calculations, a range of operating conditions was determined. These conditions are listed in Table 1. Three boilers were operated at the site with a normal fuel use of 55 g/hr (#1), 70 g/hr (#2), and 85 g/hr (#3). Average boiler use was assumed at 70 g/hr. All three boilers were ducted to one 76-foot-tall stack. During the winter months (assumed November-March), two boilers were normally in operation. During the summer months (April-October), only one boiler was in operation. The operating conditions of the boilers varied depending on whether the tubes were clean or dirty. During two 3-day periods each year, maximum heat was generated through increased boiler operations. All of these conditions are shown in Table 1.

Meteorological data were obtained from the U.S. Coast Guard at Ashtabula, Ohio, for downtown Cleveland for an 11-year period. The monthly 8-point wind roses were reduced to frequency of occurrence tables shown in Table 2. These data are believed to be representative of the area because of the similar proximity to the dominant topographic features of the region, Lake Erie.

There is an annual predominance of winds blowing from the south and southwest directions. In the winter months the southwest direction is predominant while in the summer months the south is predominant and the northerly and northeast directions become considerably more prevalent. The wind speeds shown by direction in Table 2 are average wind speeds for each month.

A screening type of air quality impact analysis was completed using the U.S. EPA PTPLU model. This model produces an analysis of maximum concentration as the function of wind speed and stability. Input to the program consists of ambient air temperature (70 degrees F) and the characteristics of the source listed in Table 1. Outputs of the program used for this analysis consist of effective height of emission, maximum ground level concentration, and distance of maximum concentration for each stability and wind speed.

The program determines for each wind speed and stability the final plume rise using methods suggested by Briggs. This plume rise is added to the physical stack height to determine the effective height of emission. The effective height is used to determine both the maximum concentration and the distance to the maximum concentration. To determine relative impact from the boiler operations, an emission rate of 1 gram per second was assumed for the summer period and 2 grams per second used for the winter period when two boilers were normally in operation.

To obtain the total relative impact, the concentration was determined as estimated by PTPLU for D (neutral adiabatic) stability at the wind speed average for each monthly wind rose direction. For example, the impact from the January northerly wind direction was determined from the resultant impact of D stability, 5.6 m/s in the PTPLU output multiplied by the percent occurrence of the month (4.84). In all cases, D stability was assumed as it is generally the most common stability found in meteorological data across the country (usually greater than 50 percent).

The estimated relative impacts determined from this method are listed in Table 3. The average boiler operating conditions were used. The change in impact when using the clean and dirty tube conditions was relatively insignificant. Because particulates created through combustion processes are very finely sized, they behave, aerodynamically, like gases. Therefore, it was assumed that the PTPLU outputs could be used directly as an indicator of particulate deposition from the plume. Direct fallout was not modeled in this exercise.

The maximum impact points were generally found between 0.7 to 1.0 kilometer distance. The direction of the maximum was to the north and northeast.

Should soil contamination be found to the north and northeast at these distances, all directions with the exception of west and northwest should be sampled, as winds blow towards these directions infrequently. Since the wind directions used are only accurate to 8 compass points (22.5 degrees), sampling should occur based on topographical considerations but spatially covering that sector.

bt:se9924G
GLT777/28

Table 1
OPERATING CONDITIONS--LASKIN BOILERS

Stack Height: 76'(232.2m)
Stack Diameter: 5'(1.52m)

	Stack Temperature °F(°K)	Flow/Velocity ACFM(m^3/s) (/m/s)		
		Summer	Winter	Maximum
Clean tubes	550(561)	5,260(2.48)/1.37	10,500(4.96)/2.73	15,600(7.36)/4.06
Average tubes	675(630)	5,900(2.78)/1.53	11,800(5.57)/3.07	17,600(8.31)/4.58
Dirty tubes	800(700)	6,560(3.10)/1.71	13,100(6.18)/3.41	19,500(9.20)/5.07

GLT777/29

Table 2 (Page 1 of 2)
SURFACE WINDS--PERCENT FREQUENCY OF DIRECTION FROM--MONTHLY

	January (%)/(mph)/(m/s)	February (%)/(mph)/(m/s)	March (%)/(mph)/(m/s)	April (%)/(mph)/(m/s)
N	4.84(12.5)(5.6)	7.84(11.1)(5.0)	12.23(12.5)(5.6)	9.31(12.3)(5.5)
NE	8.74(12.7)(5.7)	12.13(11.6)(5.2)	12.77(11.7)(5.2)	19.17(14.0)(6.3)
E	3.22 (8.0)(3.6)	2.37 (7.2)(3.2)	2.82 (7.7)(3.4)	3.05 (8.3)(3.7)
SE	6.72(11.8)(5.3)	6.66(11.2)(5.0)	6.32(12.3)(5.5)	9.03(12.7)(5.7)
S	19.35(15.7)(7.0)	16.42(15.2)(6.8)	17.74(16.0)(7.2)	15.28(14.3)(6.4)
SW	23.52(13.6)(6.0)	17.60(13.7)(6.1)	17.07(15.7)(7.0)	16.94(14.7)(6.6)
W	22.18(17.2)(7.7)	20.86(17.1)(7.6)	14.52(16.6)(7.4)	14.72(16.0)(7.2)
NW	11.42(15.6)(7.0)	16.12(12.7)(5.7)	16.53(13.8)(6.2)	12.50(12.5)(5.6)

	May (%)/(mph)/(m/s)	June (%)/(mph)/(m/s)	July (%)/(mph)/(m/s)	August (%)/(mph)/(m/s)
N	14.11 (9.8)(4.4)	13.61(10.0)(4.5)	16.26(11.2)(5.0)	16.67(11.1)(5.0)
NE	23.12(11.5)(5.1)	16.67(11.6)(5.2)	15.73(10.5)(4.7)	14.38(12.0)(5.4)
E	3.76 (6.3)(2.8)	3.61 (6.8)(3.0)	4.84 (6.3)(2.8)	4.30 (6.8)(3.0)
SE	8.06(10.0)(4.5)	7.92 (9.3)(4.2)	7.93 (8.2)(3.7)	10.75 (8.7)(3.9)
S	13.98(11.8)(5.3)	17.22(11.0)(4.9)	18.55(10.8)(4.8)	20.70(10.6)(4.7)
SW	14.78(13.2)(5.9)	17.08(11.3)(5.0)	14.78(11.2)(5.0)	13.31(10.4)(4.6)
W	12.23 (9.6)(4.3)	11.94(11.9)(5.3)	10.22(10.0)(4.5)	8.74 (9.3)(4.2)
NW	9.95 (9.8)(4.4)	11.94 (8.9)(4.0)	11.69 (8.2)(3.7)	11.16 (9.2)(4.1)

Table 2 (Page 2 of 2)

	September (%)/(mph)/m/s)	October (%)/(mph)/(m/s)	November (%)/(mph)/(m/s)	December (%)/(mph)/(m/s)
N	14.31(12.4)(5.5)	10.75(14.3)(6.4)	5.55(13.4)(6.1)	5.51(13.3)(5.9)
NE	12.92(12.0)(5.4)	8.33(12.0)(5.4)	5.97(11.4)(5.1)	8.06(11.6)(5.2)
E	5.42(6.9) (3.1)	3.36(7.1) (3.2)	3.19(7.2) (3.2)	3.09 (7.8)(3.5)
SE	11.25 (8.9)(4.0)	10.35(10.6)(4.7)	6.67(11.8)(5.3)	6.32(12.3)(5.5)
S	21.94(12.6)(5.6)	22.72(12.9)(5.8)	23.47(16.2)(7.2)	22.18(15.6)(7.0)
SW	14.58(11.5)(5.1)	19.22(12.6)(5.6)	24.31(13.3)(5.9)	24.60(12.9)(5.8)
W	9.44(11.4)(5.1)	12.63(12.8)(5.7)	17.08(15.5)(6.9)	20.43(16.3)(7.3)
NW	10.14(10.7)(4.8)	12.63(14.4)(6.4)	13.75(17.0)(7.6)	9.81(15.6)(7.0)

	Annual
N	10.92
NE	13.17
E	3.59
SE	8.16
S	19.13
SW	18.15
W	14.58
NW	12.30

Table 3
ESTIMATED RELATIVE IMPACTS FROM OPERATION OF OIL BURNERS

Direction From Stack	Relative Impact (percent of maximum)	Approximate Distance (km)
N	100	0.7-0.8
NE	97	0.7-0.9
E	73	0.65-0.85
SE	62	0.7-0.85
S	57	0.7-1.0
SW	67	0.7-1.0
W	18	0.8-1.3
NW	44	0.75-1.0

GLT777/31

Fieldwork Memorandum A-5
SEDIMENT SAMPLING

FIELDWORK MEMORANDUM A-5

TO: Donna Twickler/Remedial Project Manager, U.S. EPA

FROM: Randy Videkovich/Site Manager, CH2M HILL

RE: Sediment Sampling
Laskin Poplar Oil Site

PREPARED BY: Woodward-Clyde Consultants

DATE: August 20, 1986

REVISED BY: CH2M HILL, February 25, 1988

This memorandum was prepared by Woodward-Clyde Consultants for the Phase I RI under REM/FIT Contract No. 68-01-6692, Work Assignment 32.5L03.0. It has subsequently been revised by CH2M HILL during the Phase II RI/FS. Revisions are limited to format changes.

GENERAL

Sediment samples were collected from Cemetery Creek, the freshwater pond, the retention pond, and the middle treatment pond. Sediment samples were collected from Cemetery Creek to determine if contaminant levels in the creek sediments might require additional evaluation. Samples were collected from the freshwater pond, retention pond, and middle treatment pond was to determine the presence of site contamination in those facilities.

General sample locations (Figure A-5-1) were discussed with U.S. EPA representatives during the onsite reconnaissance on November 14, 1983. Specific sample locations were selected by the sampling team based on creek access to areas where sediments had collected. Selected sample locations in Cemetery Creek were assumed to be representative of conditions upstream of the site (SD001), adjacent to the site (SD002), and at two locations downstream of the site (SD003 and SD004).

At each of the Cemetery Creek sample locations, sediment was obtained from three different places along the creek bank. Each sample location was noted with the letter A, B or C.

The locations of the freshwater pond sediment samples (SD005 and SD006) were chosen in the deeper portions of the pond adjacent to the tank area. Sediment sampling depths were about 13 feet below the water surface. Sediment sample locations in the retention pond (SD007 and SD008) were selected to be representative of the deep and shallow areas of the pond. Sediment sampling depths were about 1 to 2 feet below the water surface for SD007 and 3 to 4 feet for SD008. Sediment was sampled from the middle of the three treatment ponds (SD009) on the basis of reported information that the pond had been a treatment facility during the emergency treatment of Pond 19 and retention pond waters. Sediment sample locations were numbered SD001 through SD009 in accordance with the Sample Plan.

The Cemetery Creek sediment samples were obtained during the period of November 30 through December 3, 1983. The freshwater pond sediment samples were obtained on November 17, 1983. The retention pond samples were obtained on December 7, 1983, and the middle treatment pond samples were obtained on December 3, 1983.

SAMPLING PROCEDURES

Sediment samples were obtained by stainless steel hand corer, stainless steel beaker, or stainless steel spoon. Sediment samples from Cemetery Creek were obtained by either the stainless steel hand corer or a stainless steel spoon. If sufficient material existed in the sample area, an attempt was made to use the hand corer for obtaining the sample. However, where insufficient sediment was found, the stainless steel spoon was used. At Cemetery Creek sample location SD001B, the sediment depth was sufficient to obtain a core sample that could be sectioned by depth. The sample was removed from the core tube, placed in a stainless steel pan, and divided using a stainless steel knife. Samples SD001B-001 and 002 were from 0 to 6 inches below the stream bottom. Samples SD001B-003 and 004 were from 6 to 12 inches below the stream bottom. At all other locations, samples obtained with the hand corer or stainless steel spoon were placed in stainless steel pans to form a composite sample.

The freshwater pond sediment samples were obtained with the stainless steel hand corer. At each location, core samples were obtained and placed in a stainless steel pan, where they were thoroughly mixed to form a composite sample. Samples from the retention pond and the middle treatment pond were obtained using a stainless steel beaker attached

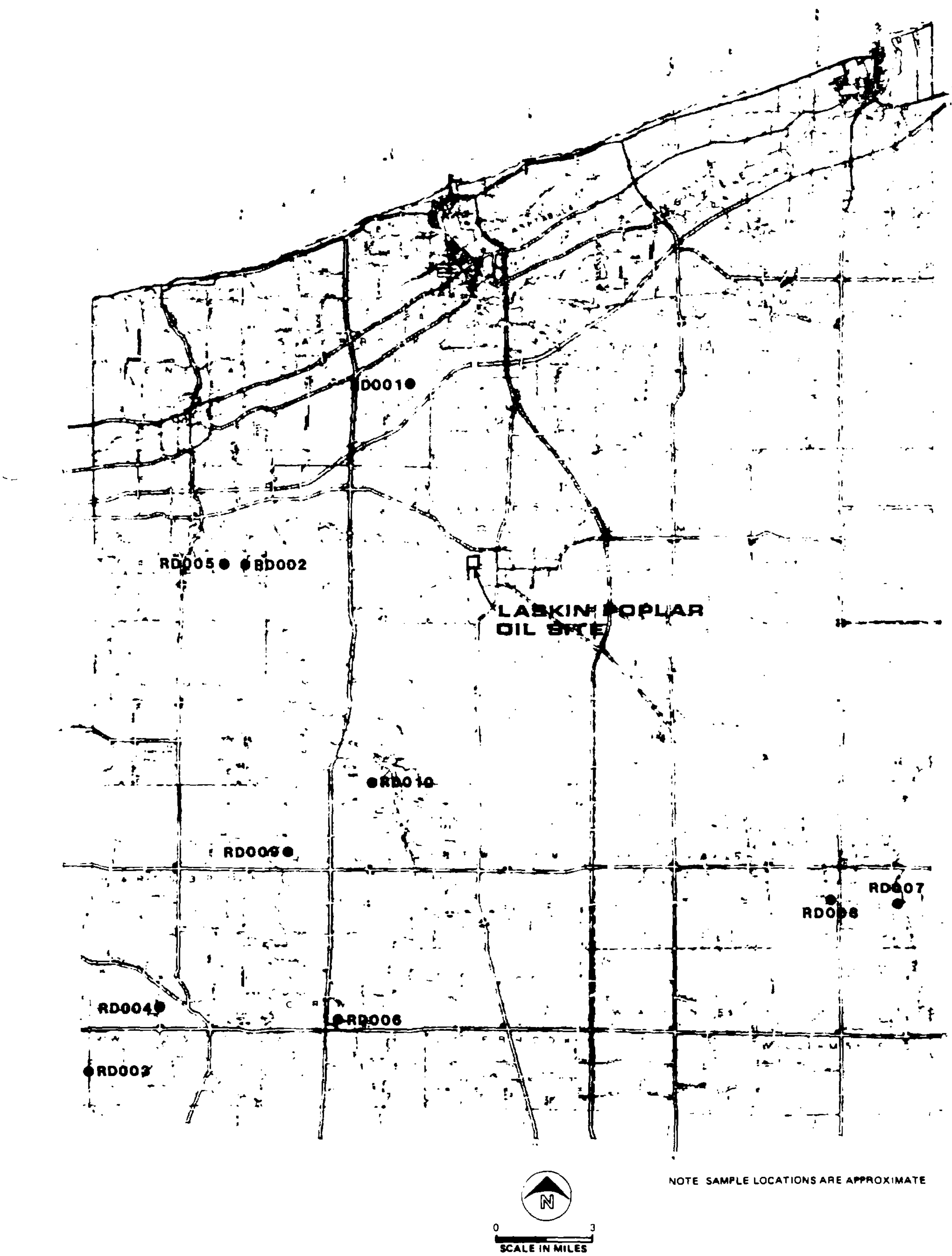
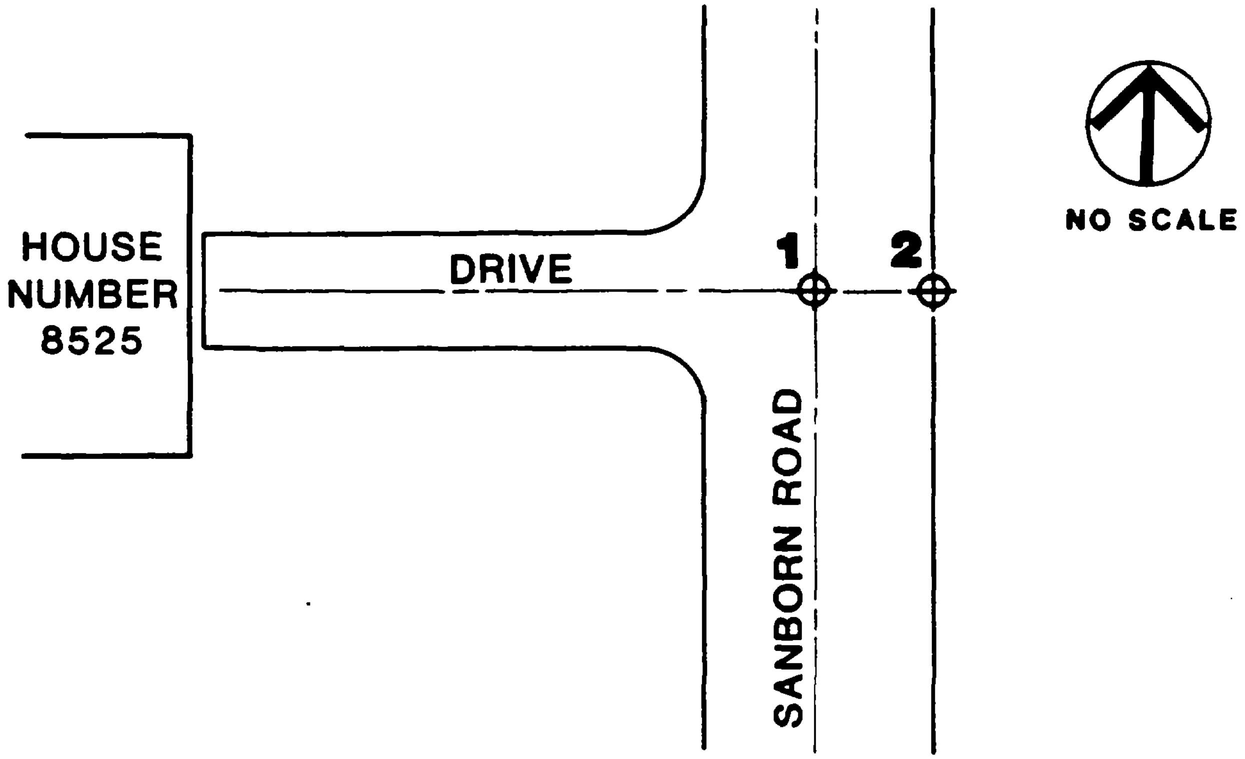


FIGURE A-6-1
ROAD OILING SAMPLE LOCATIONS
LASKIN POPLAR OIL

Attachment 1
FIELDWORK MEMORANDUM A-6

SITE RD001



Sample Location: 1-Intersection of centerlines of Sanborn Road and gravel drive (House #8525).

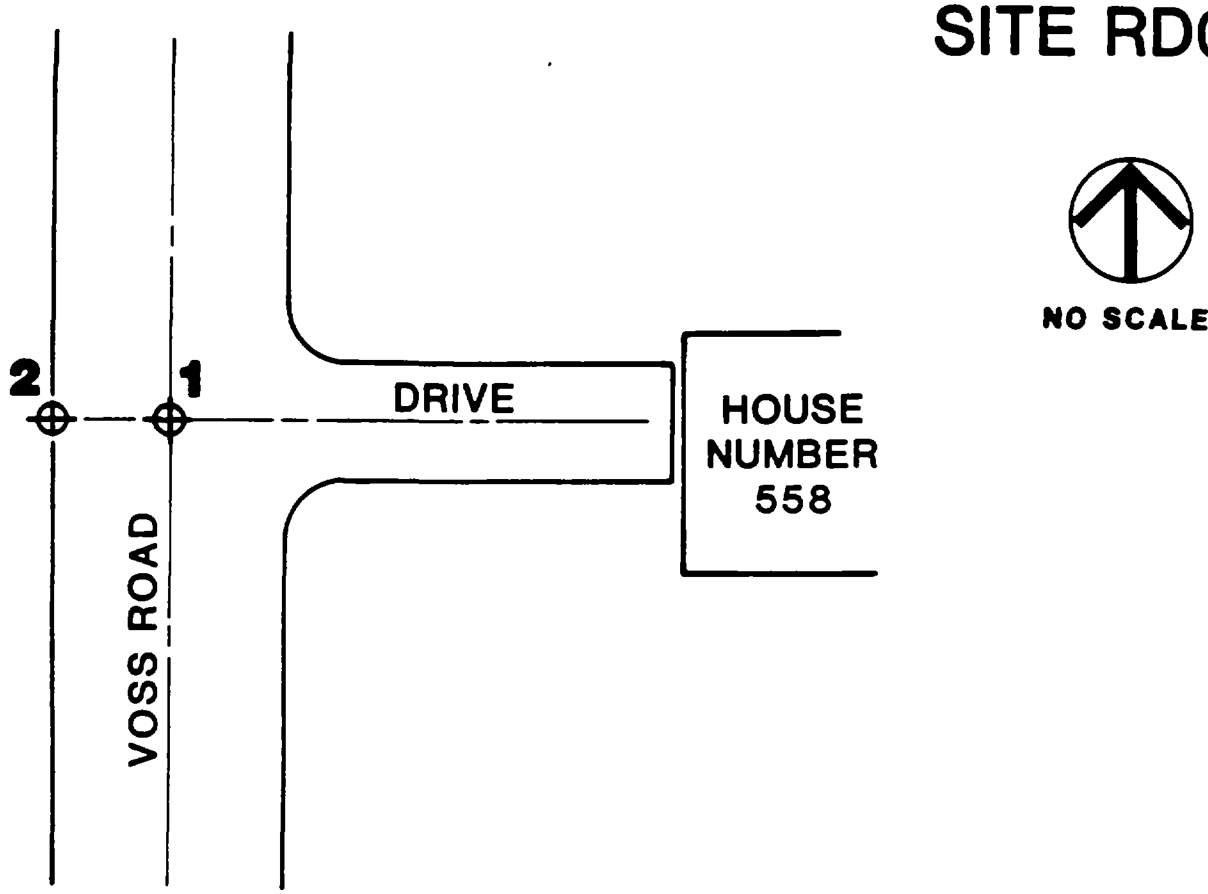
2-Intersection of east edge of Sanborn Road and centerline of gravel drive (House #8525).

Sample Numbers:

LPO-RD001-001-1
LPO-RD001-002-1
LPO-RD001-003-2
LPO-RD001-004-2

ROAD OILING SAMPLING SITE RD001
LASKIN-POPLAR OIL, JEFFERSON, OHIO

SITE RD002



Sample Location: 1-Intersection of centerlines of Voss Road and gravel drive (House #558).

2-Intersection of west edge of Voss Road and centerline of gravel drive (House #558).

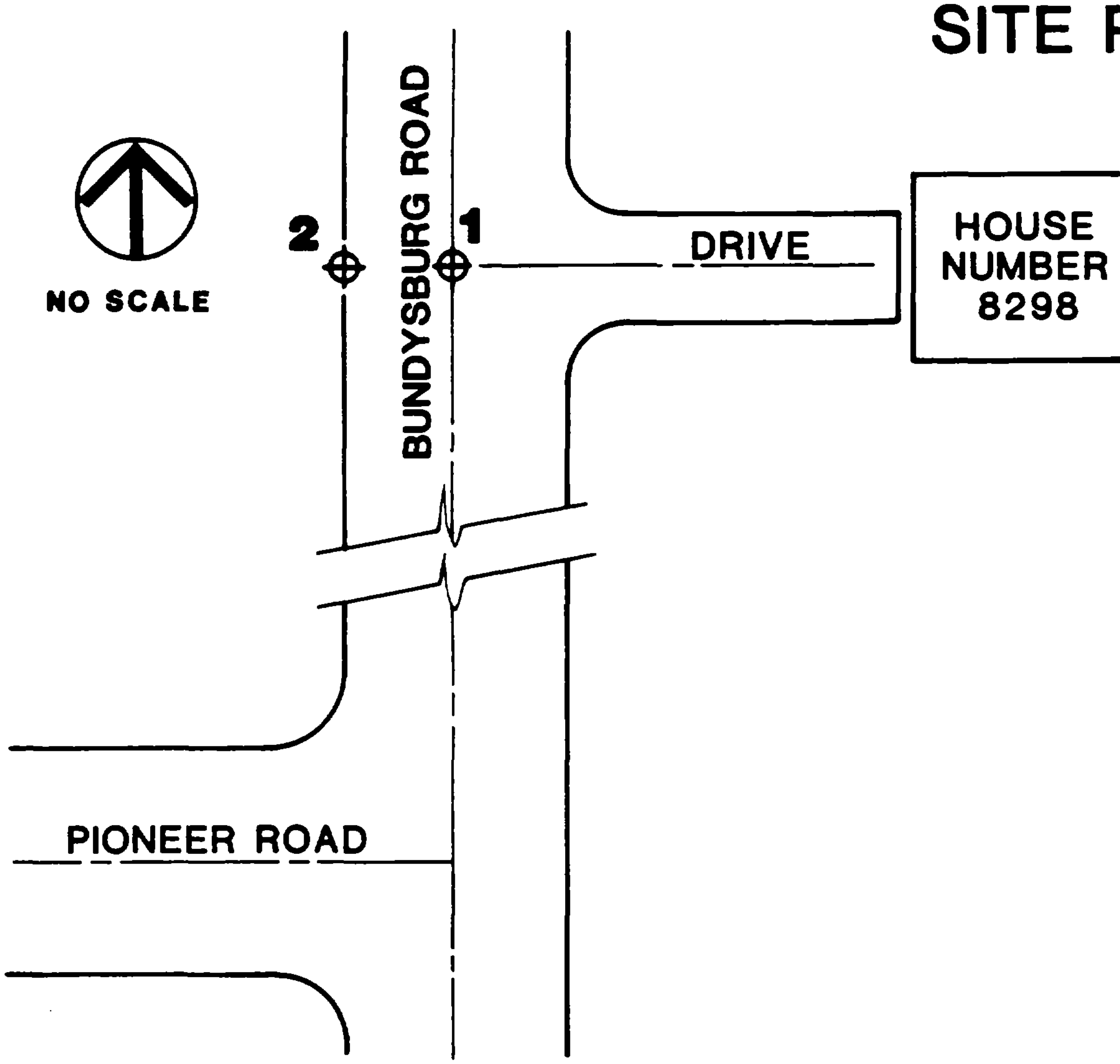
Sample Numbers:

LPO-RD002-001-1
LPO-RD002-002-1
LPO-RD002-003-2
LPO-RD002-004-2
LPO-RD002-005-2
LPO-RD002-006-2
LPO-RD002-007-2
LPO-RD002-008-2

ROAD OILING SAMPLING SITE RD002

LASKIN-POPLAR OIL, JEFFERSON, OHIO

SITE RD003



Sample Location: 1-Intersection of the centerlines of Bundysburg Road and gravel drive (House #8298).

2-Intersection of west edge of Bundysburg Road and centerline of Gravel Drive (House #8298).

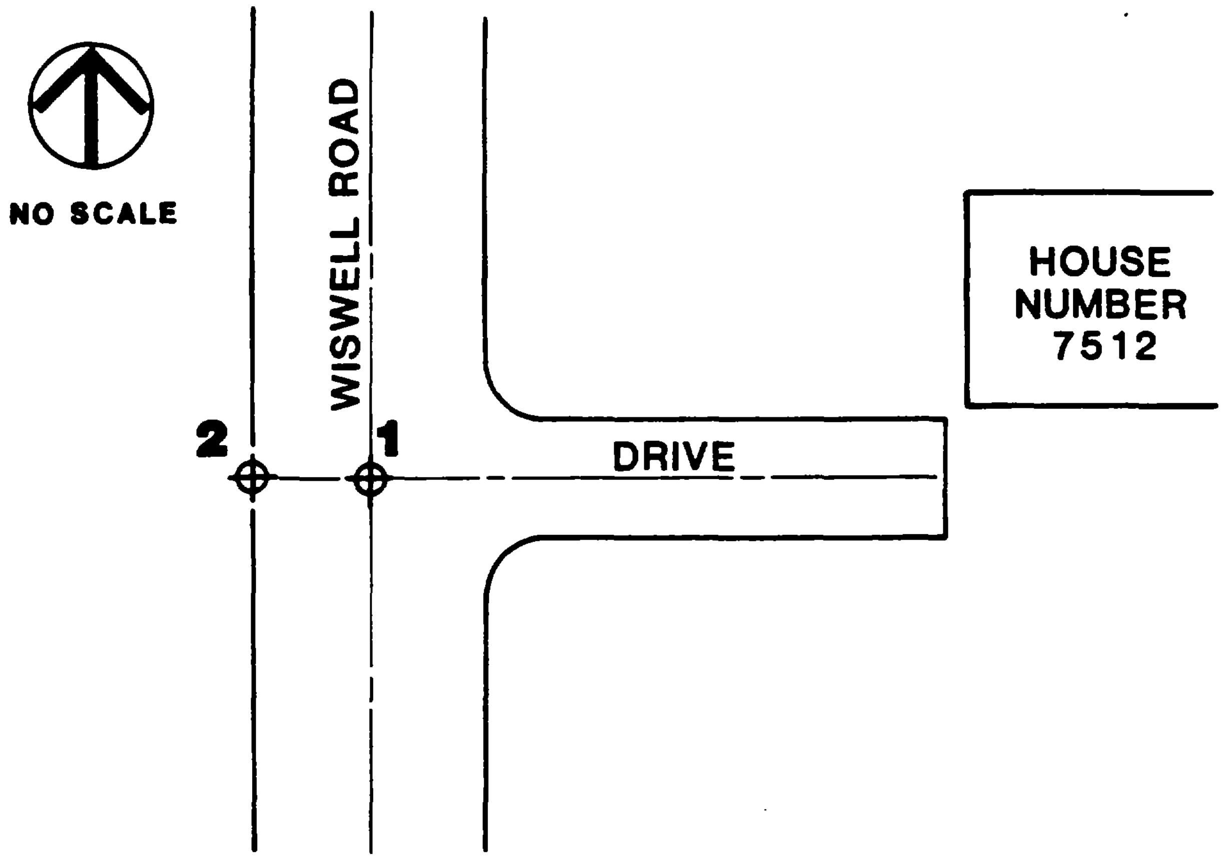
Sample Numbers:

LPO-RD003-001-1
LPO-RD003-002-1
LPO-RD003-003-2
LPO-RD003-004-2

ROAD OILING SAMPLING SITE RD003

LASKIN-POPLAR OIL, JEFFERSON, OHIO

SITE RD004



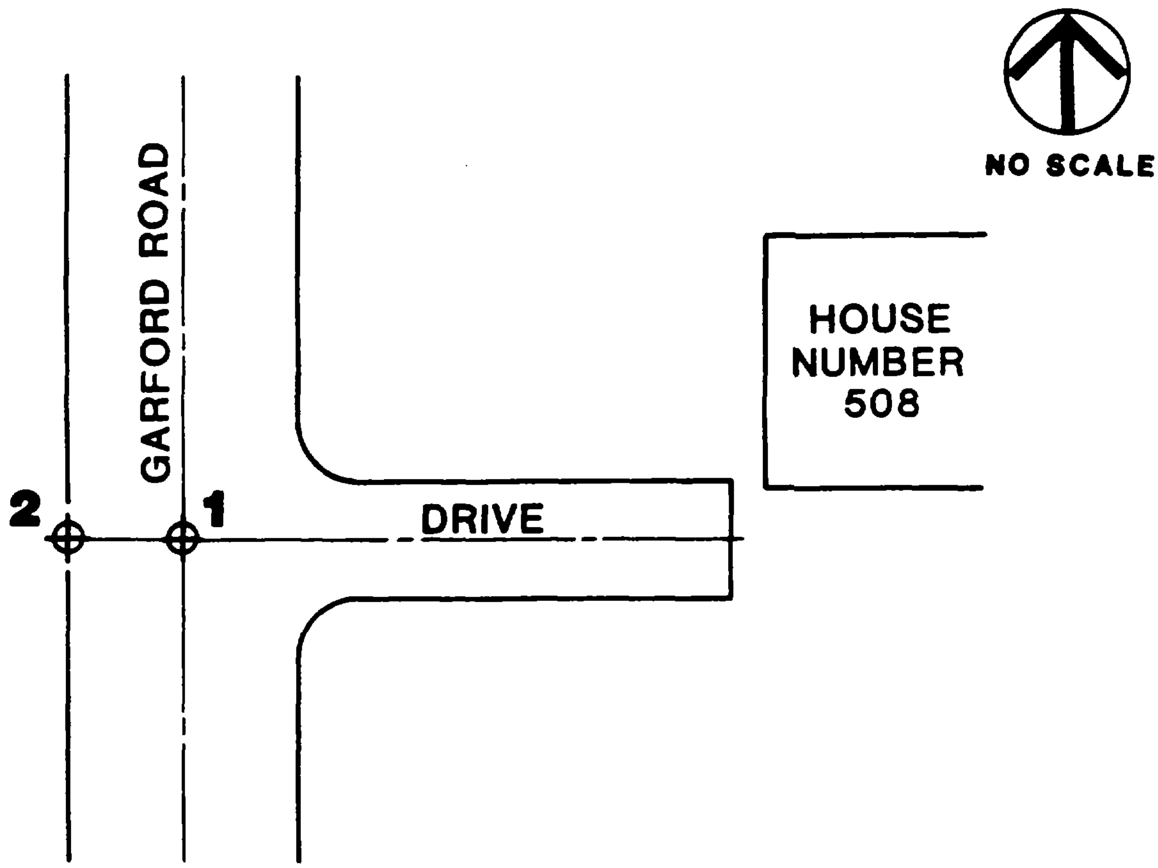
Sample Location: 1-Intersections of centerlines of Wiswell Road and gravel drive (House #7512).

2-Intersection of west edge of Wiswell Road and centerline of gravel drive (House #7512).

Sample Numbers: LPO-RD004-001-1
LPO-RD004-002-1
LPO-RD004-003-2
LPO-RD004-004-2

ROAD OILING SAMPLING SITE RD004
LASKIN-POPLAR OIL, JEFFERSON, OHIO

SITE RD005



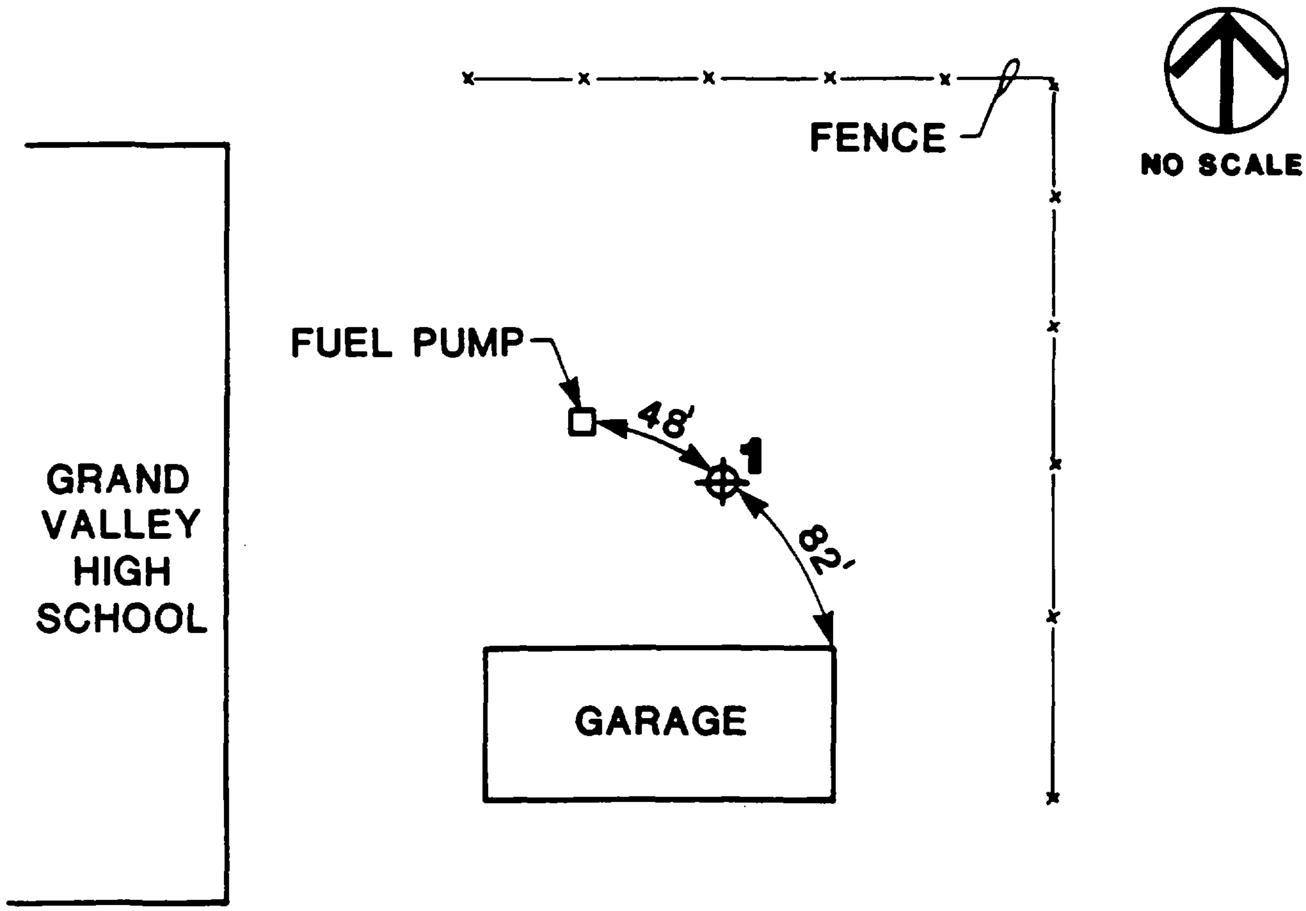
Sample Location: 1-Intersections of centerlines of Garford Road and gravel drive (House #508).

2-Intersection of west edge of Garford Road and and centerline of gravel drive (House #508).

Sample Number: LPO-RD005-001-1
LPO-RD005-002-1
LPO-RD005-003-2
LPO-RD005-004-2

ROAD OILING SAMPLING SITE RD005
LASKIN-POPLAR OIL, JEFFERSON, OHIO

SITE RD006

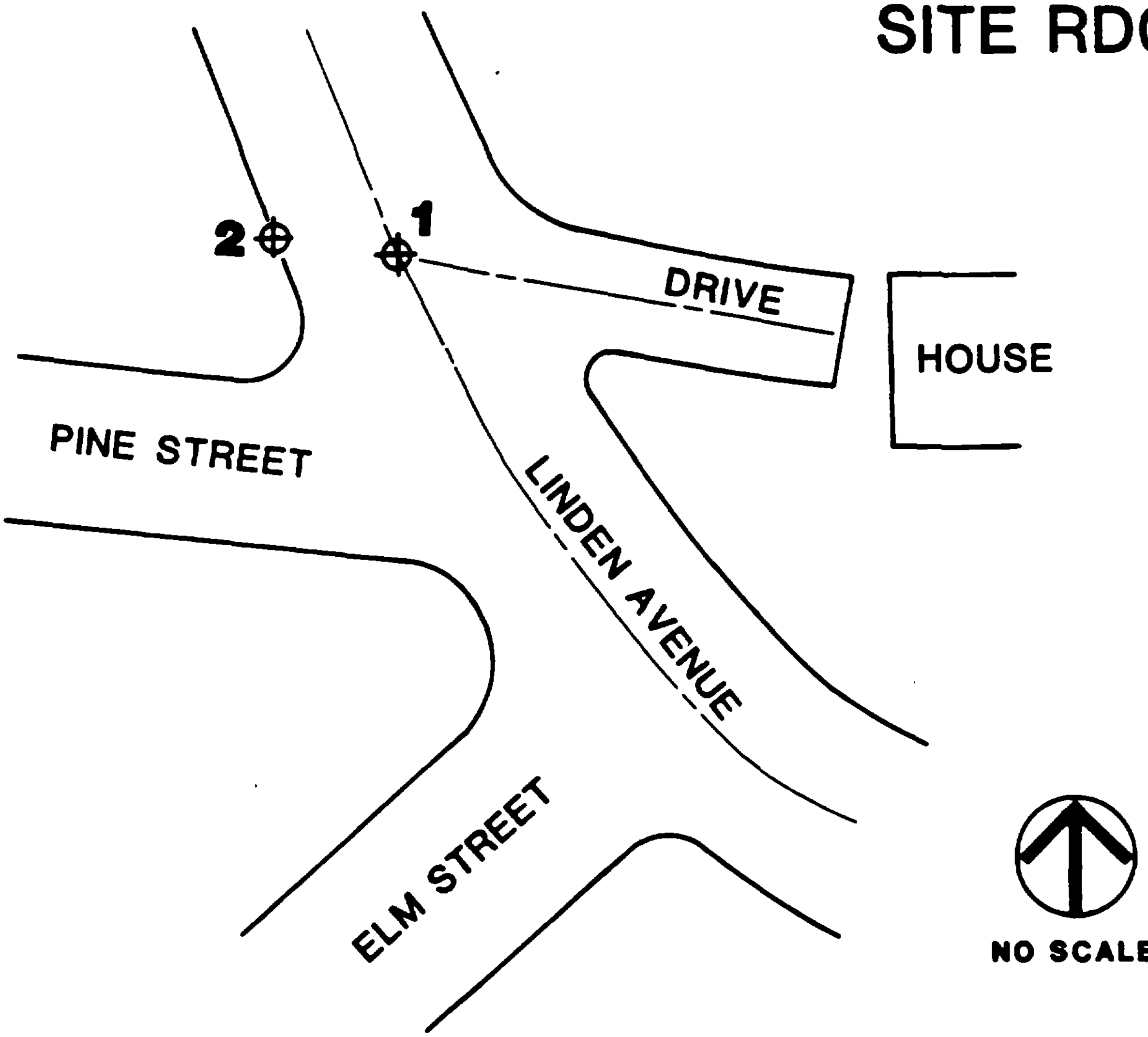


Sample Location: Parking area located behind (east) Grand Valley High School Building.

Sample Number: LPO-RD006-001-1
LPO-RD006-002-1

ROAD OILING SAMPLING SITE RD006
LASKIN-POPLAR OIL, JEFFERSON, OHIO

SITE RD007



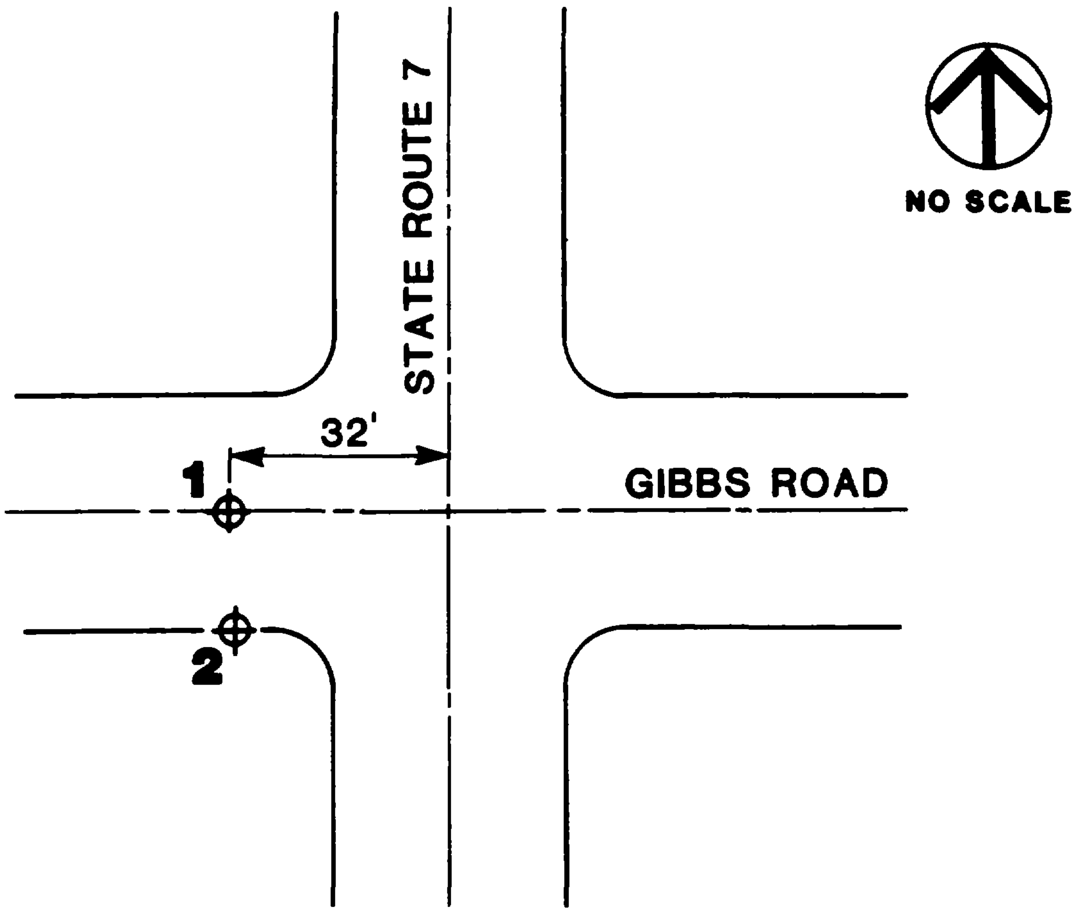
Sample Location: 1-Intersection of centerlines of Linden Avenue and gravel drive.

2-Intersection of southwest edge of Linden Avenue and centerline gravel drive.

Sample Number: LPO-RD007-001-1
LPO-RD007-002-1
LPO-RD007-003-2
LPO-RD007-004-2

ROAD OILING SAMPLING SITE RD007
LASKIN-POPLAR OIL, JEFFERSON, OHIO

SITE RD008



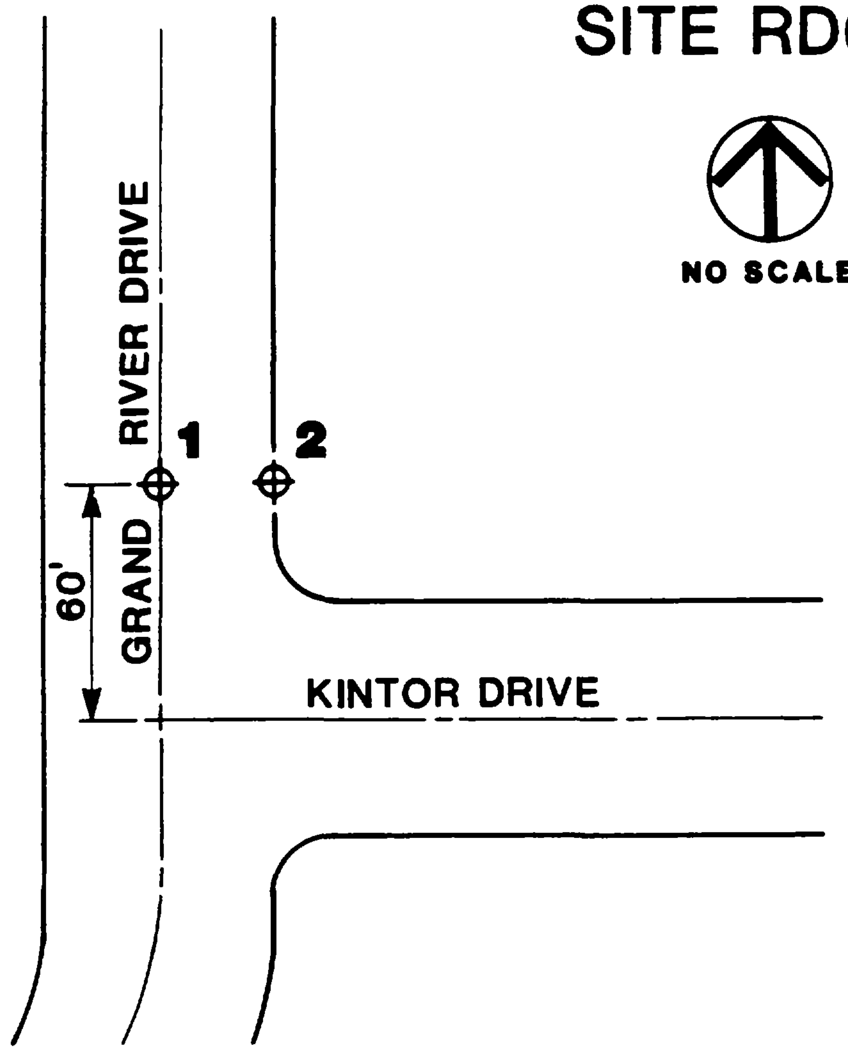
Sample Location: 1-32 feet west of centerline of State Route #7, along centerline of Gibbs Road.

2-32 feet west of centerline of State Route #7 along south edge of Gibbs Road.

Sample Numbers: LPO-RD008-001-1
LPO-RD008-002-1
LPO-RD008-003-2
LPO-RD008-004-2

ROAD OILING SAMPLING SITE RD008
LASKIN-POPLAR OIL, JEFFERSON, OHIO

SITE RD009



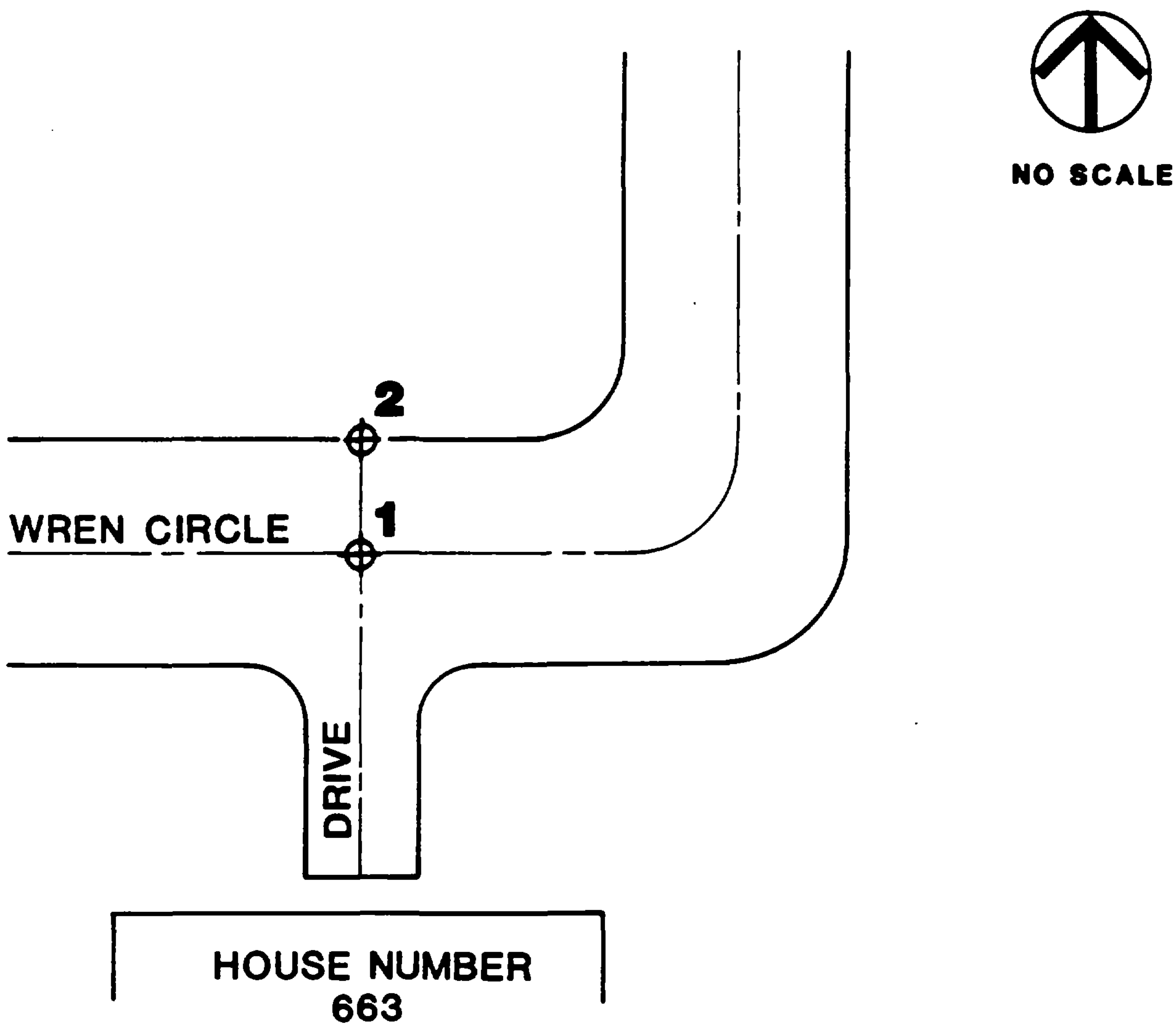
Sample Location: 1-60 feet north of centerline of Kintor Drive along centerline of Grand River Drive.

2-60 feet north of centerline of Kintor Drive along eastern edge of Grand River Drive.

Sample Numbers:
LPO-RD009-001-1
LPO-RD009-002-1
LPO-RD009-003-2
LPO-RD009-004-2
LPO-RD009-005-2
LPO-RD009-006-2

ROAD OILING SAMPLING SITE RD009
LASKIN-POPLAR OIL, JEFFERSON, OHIO

SITE RD010



Sample Location: 1-Intersection of centerlines of Wren Circle and gravel drive (House #663).

2-Intersection at north edge of Wren Circle and gravel drive (House #663).

Sample Numbers: LPO-RD010-001-1
LPO-RD010-002-1
LPO-RD010-003-2
LPO-RD010-004-2

ROAD OILING SAMPLING SITE RD010
LASKIN-POPLAR OIL, JEFFERSON, OHIO

Fieldwork Memorandum A-7
BOILER/STACK RESIDUE SAMPLING

GLT777/24-7

CH2M HILL

FIELDWORK MEMORANDUM A-7

TO: Donna Twickler/Remedial Project Manager, U.S. EPA

FROM: Randy Videkovich/Site Manager, CH2M HILL

RE: Boiler/Stack Residue Sampling
Laskin Poplar Oil Site

PROJECT: Woodward-Clyde Consultants

DATE: August 20, 1986

REVISED BY: CH2M HILL, February 25, 1988

This memorandum was prepared by Woodward-Clyde Consultants for the Phase I RI under REM/FIT Contract No. 68-01-6992, Work Assignment 32.5L03.0. It has subsequently been revised by CH2M HILL during the Phase II RI/FS. Revisions are limited to format changes.

GENERAL

During the November 15, 1983, site reconnaissance of the boilers and stack, it was determined that residue from the four Laskin Poplar Oil boilers could be sampled through individual access doors in each boiler. In a similar fashion, the stack could be sampled through an access/clean-out door located at the base of the stack on the south side. The purpose of the boiler/stack sampling was to determine the presence of contaminants in the ash and, if possible, in the residue on the boiler walls and heat exchangers. Figure A-7-1 is a sketch of the boiler room showing estimated boiler locations and the stack location.

Ash was observed in the bottom of Boiler No. 1, but the other boilers contained little or no ash. Samples of the ash in Boiler No. 1 were obtained on December 1, 1983. Samples in Boilers No. 2, 3, and 4 were obtained from the residue on the walls of the boilers and heat exchangers. The sample locations (see Figure A-7-1) were numbered in accordance with the Sample Plan designations BS001 through BS004. The A or B suffixes indicate a separate sample location or set of samples from the same boiler.

During site reconnaissance, a large quantity of ash was observed at the base of the stack. Stack samples were obtained from the ash on December 2, 1983. The stack samples were numbered BS005 in accordance with the Sample Plan.

SAMPLING PROCEDURES

Boiler residue samples were obtained using a long-handled, stainless steel spoon to scrape boiler scale from the side-walls and to remove ash from the bottoms of the boilers. Residue samples obtained from each sample location were placed in a stainless steel pan, mixed thoroughly, and placed in appropriate glass containers. Samples from Boiler No. 1 were taken from the ash in the bottom of the boiler, while samples from Boilers No. 2, 3, and 4 were taken from the walls of the boilers and the heat exchangers.

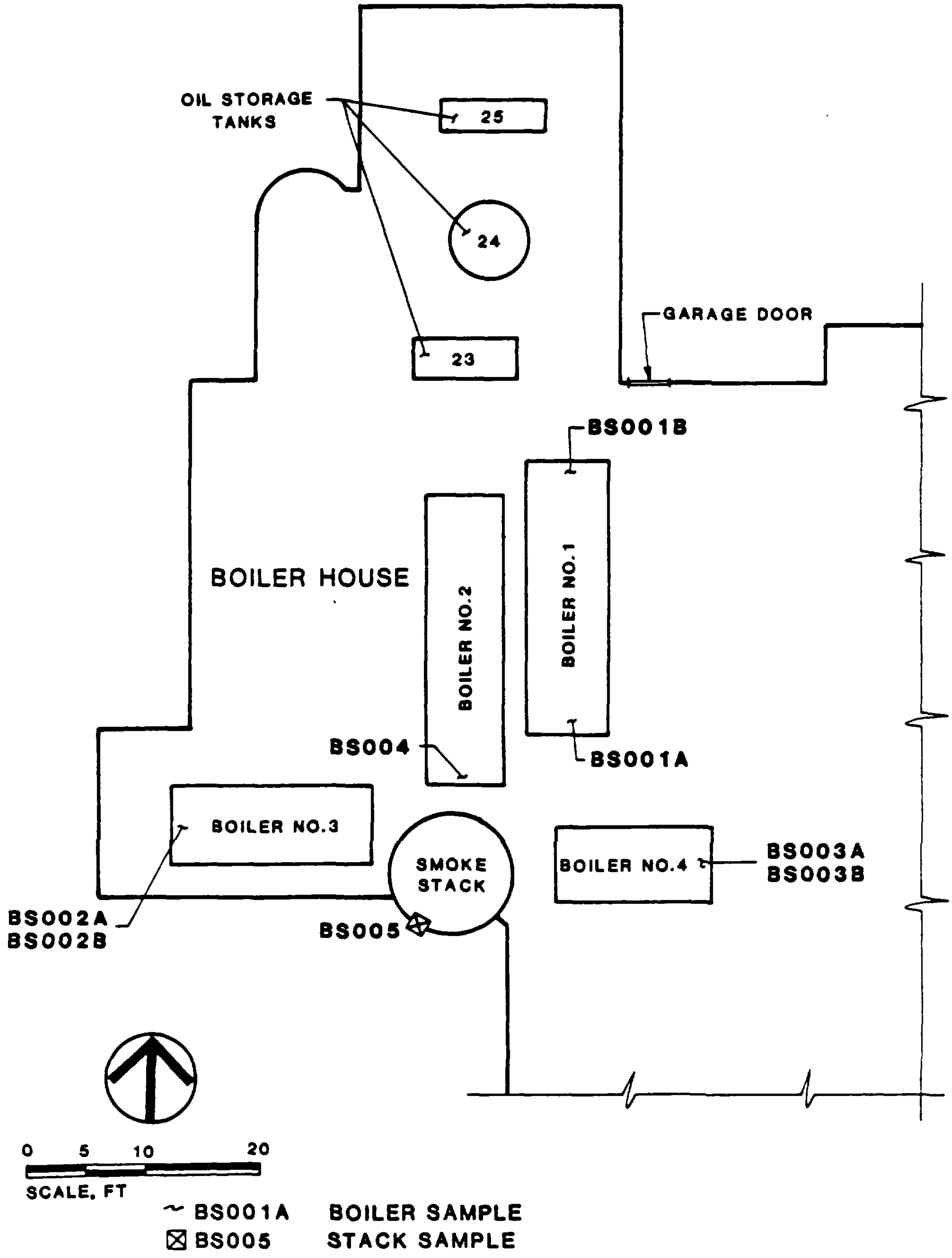
Residue from the stack was obtained with a long-handled, stainless steel spoon from the mound of ash located at the access door. Ash was taken from the top of the ash pile to a depth of approximately 3 or 4 inches. The ash was put in a stainless steel beaker, mixed thoroughly, and placed in sample jars. An unsuccessful attempt was made to scrape residue from the stack walls.

Duplicate samples were obtained from the stack residues. The duplicate sample was obtained from the same beaker of residue as was the primary sample. Blank samples were prepared from the stack residue sampling. The blank samples were prepared by pouring diatomaceous earth into a stainless steel beaker, mixing the diatomaceous earth with a stainless steel spoon, and transferring the sample to sample jars with the same spoon.

Eleven boiler/stack samples were sent to the Special Analytical Services section of the Contract Laboratory Program for HSL inorganic and organic constituent, chlorodibenzodioxin, and chlorodibenzofuran analyses.

Sampling equipment used during the field investigation was decontaminated before each sampling event. Decontamination consisted of a detergent wash (sodium carbonate and trisodium phosphate) and distilled water rinses. Equipment was allowed to air dry. During wet weather conditions, however, the sampling equipment was wiped dry with paper towels.

Equipment used for sampling the stack and boilers were decontaminated by washing in a detergent (Alconox) solution and



NOTE: BOILER AND TANK LOCATIONS AND DIMENSIONS ARE APPROXIMATE

FIGURE A-7-1
BOILER HOUSE SAMPLE LOCATION PLAN
LASKIN-POPLAR OIL, JEFFERSON, OHIO

rinsing with tap water, methanol, 1,1,1 trichloroethane, and distilled water in sequential order. Any sampling equipment that could not be decontaminated was containerized in 55-gallon drums and left onsite.

GLT777/17

Fieldwork Memorandum A-8
SURFACE WATER SAMPLING

CH2M HILL

FIELDWORK MEMORANDUM A-8

TO: Donna Twickler/Remedial Project Manager, U.S. EPA

FROM: Randy Videkovich/Site Manager, CH2M HILL

RE: Surface Water Sampling
Laskin Poplar Oil Site

PREPARED BY: Woodward-Clyde Consultants

DATE: August 20, 1986

REVISED BY: CH2M HILL, February 25, 1988

This memorandum was prepared by Woodward-Clyde Consultants for the Phase I RI under REM/FIT Contract No. 68-01-6692, Work Assignment 32.5L03.0. It has subsequently been revised by CH2M HILL during the Phase II RI/FS. Revisions are limited to format changes.

GENERAL

Surface water samples taken during the Phase I RI were obtained from Cemetery Creek, three onsite ponds, and three surface runoff areas. The samples were taken to identify the levels of contamination in both onsite and offsite surface waters. All surface water sample locations are shown on Figure A-8-1.

Four sample locations were chosen in Cemetery Creek. One location was upstream of the site, one was adjacent to the site, and two were downstream of the site, the farthest being approximately three-quarters of a mile away. Surface water samples were obtained from the same locations as the sediment from Cemetery Creek (see Appendix A-5, Sediment Sampling).

One water sample was obtained from the middle treatment pond at the same location as the sediment sample from the same pond. Two samples were obtained from the retention pond, also at the same locations as the sediment samples. Two water samples were obtained from near the center of the freshwater pond, one from near the bottom of the pond, and one from near the water surface.

During site reconnaissance on November 14, 1983, three tentative locations (Figure A-8-1) were selected for wet weather sampling. Two locations were chosen to be representative of surface water flow in the eastern and western portions of the retention pond area, and one location was assumed to be representative of surface water flow unaffected by the onsite conditions. On November 27 and 28, 1983, a storm produced rainfall at the Laskin Poplar Oil site. Rainfall was measured at a station about 7 miles east of the site by Mr. Mat Johns (1986), a U.S. Weather Bureau cooperative weather observer. Mr. Johns recorded 0.67 inch and 0.23 inch of rain, respectively, for the 24-hour periods ending at 8:00 a.m. on November 28 and 29. On November 29, the sampling locations were observed to contain sufficient water for sampling and sampling was conducted about midday on November 29. During earlier site visits, all locations had been dry or nearly dry.

Cemetery Creek water samples were numbered SW001 through SW004 in accordance with the Sample Plan. Freshwater pond samples were numbered SW005 and SW006. Retention pond water samples were numbered SW007 and SW008, and the middle treatment pond sample was numbered SW009. Onsite wet weather samples were numbered WW001 and WW002. The offsite sample was numbered WW003.

Cemetery Creek water samples were obtained on November 16, freshwater pond samples were obtained on November 17, and retention pond and middle treatment pond water samples were obtained on December 7. Wet weather water samples were collected on November 29.

SAMPLING PROCEDURES

With the exception of the freshwater pond, all water samples were obtained by personnel standing on shore using a decontaminated stainless steel beaker attached to an extension pole. Before the sample bottles was filled, the beaker was rinsed with sample water to remove cleaning fluids. Sample bottles were filled in approximately equal increments from each beaker of sample water. At the retention pond, where approximately 0.5 to 0.75 inch of oil coated the water surface, the oil was temporarily moved to expose a relatively clean water surface before submerging the stainless steel beaker. The water surface was kept relatively clear of oil until the water sample was obtained.

Water samples from the freshwater pond were obtained from a boat. Sample SW005 was obtained by hand-dipping the sample

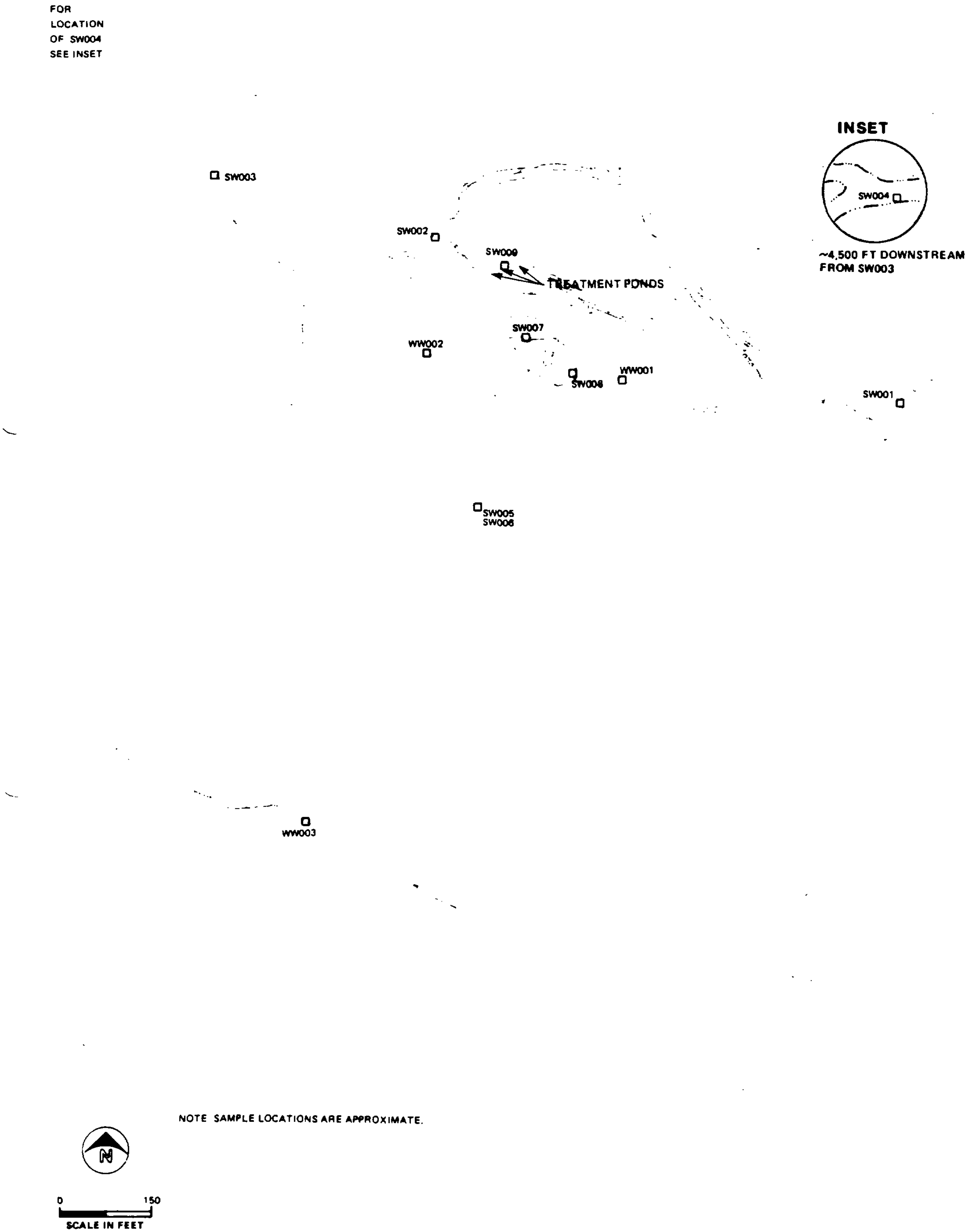


FIGURE A-8-1
SURFACE WATER SAMPLING
LASKIN POPLAR OIL

bottles approximately 6 inches below the water surface. Water sample SW006 was obtained with a decontaminated stainless steel Kemmerer sampler. The depth of the water was estimated to be 19 feet from a weighted-line sounding of the pond bottom. The Kemmerer sampler was lowered to approximately 18 feet to obtain a discrete water sample from a depth of 16 to 18 feet. After positioning the sampler, the messenger was sent down the suspending line to close the sampler. The sampler was then recovered and sample jars were incrementally filled. When additional water was required to completely fill the sample jars, the Kemmerer sampler was repositioned at approximately the same depth. Surface water samples were not filtered in the field.

Surface water duplicate samples were obtained at locations SW002, SW005, SW007, and WW002. Duplicate samples were obtained in the same manner as for the primary samples. Blank samples were obtained at locations SW002, SW005, SW007, and WW002. The blank samples were obtained by pouring ultra-pure distilled water into the appropriate sampling equipment and then incrementally filling the sample bottles from the sampling equipment.

Twenty samples were sent to the Contract Laboratory Program (CLP) for HSL organic and inorganic constituent analyses. Each organic constituent sample consisted of two 40 ml VOC analysis vials and two 0.5-gallon glass jugs, while each inorganic constituent sample consisted of two 1-liter plastic bottles. A total of 14 samples (8 primary, 3 duplicates, 3 blanks) were sent to the CLP for oil and grease testing under Special Analytical Services. Each sample consisted of two 16-ounce glass jars. Surface water samples sent for oil and grease analyses were field preserved with 10 ml of 1:1 H_2SO_4.

Sampling equipment used during the field investigation was decontaminated before each sampling event. Decontamination consisted of a detergent wash (sodium carbonate and trisodium phosphate) and distilled water rinses. Equipment was allowed to air dry. During wet weather conditions, however, the sampling equipment was wiped dry with paper towels.

Fieldwork Memorandum A-9
GROUNDWATER SAMPLING

CH2M HILL

FIELDWORK MEMORANDUM A-9

TO: Donna Twickler/Remedial Project Manager, U.S. EPA

FROM: Randy Videkovich/Site Manager, CH2M HILL

RE: Groundwater Sampling
Laskin Poplar Oil Site

PREPARED BY: Woodward-Clyde Consultants

DATE: August 20, 1986

REVISED BY: CH2M HILL, February 25, 1988

This memorandum was prepared by Woodward-Clyde Consultants for the Phase I RI under REM/FIT Contract No. 68-01-6692, Work Assignment 32.5L03.0. It has subsequently been revised by CH2M HILL during the Phase II RI/FS. Revisions are limited to format changes.

GENERAL

All groundwater monitoring wells except well SN005 were purged on December 2, 1983, before sampling to let fresh groundwater into the wells. The wells were purged using a stainless steel bailer until only small quantities of water could be drawn out of the wells with the bailer. Groundwater levels were measured and recorded before sampling. The groundwater level in each well was allowed to stabilize before groundwater sampling proceeded.

SAMPLING PROCEDURE

Groundwater samples were taken on December 5, 1983, using two samplers: a decontaminated Kemmerer sampler and a decontaminated stainless steel bailer. Before sampling, the groundwater level in each well was measured and the measurement recorded in the field book.

The Kemmerer sampler was used to obtain groundwater samples for volatile organic analyses (VOA). The Kemmerer sampler was lowered to the bottom of each well using a nylon rope and then lifted approximately 1 foot. The sampler was closed by the messenger and pulled out of the well. The VOA vials were filled through the bottom valve on the sampler.

Once VOA samples had been obtained, a stainless steel bailer was lowered into the well to obtain the remaining samples. Sample containers were filled alternately with the bailer by pouring equal amounts of water from each bailer into each container. The sample containers, other than the VOA vials, were rinsed with water from the well before filling. One set of duplicate and blank samples was obtained from well GW002. Blank samples consisted of ultra-pure distilled water poured into the samplers and then poured into the appropriate sample containers.

Groundwater samples were numbered GW001 to GW005 in accordance with the Sample Plan so that the sample number would refer to the monitoring well number. For example, groundwater samples from well SN002 were numbered GW002.

Groundwater samples to be analyzed for metals and cyanide were field filtered and preserved with 1:1 HNO_3 and 6N NaOH, respectively. Sample containers used for groundwater analysis were: two 40-ml glass VOA vials, two 0.5-gallon amber glass bottles, and two 1-liter high density polyethylene bottles. Six groundwater samples were sent to the Contract Laboratory Program for HSL organic and inorganic constituent analysis.

Sampling equipment used during the field investigation was decontaminated before each sampling event. Decontamination consisted of a detergent wash (sodium carbonate and trisodium phosphate) and distilled water rinses. Equipment was allowed to air dry. During wet weather conditions, however, the sampling equipment was wiped dry with paper towels.

Fieldwork Memorandum A-10
AQUATIC LIFE SAMPLING

GLT777/24-10

CH2M HILL

FIELDWORK MEMORANDUM A-10

TO: Donna Twickler/Remedial Project Manager, U.S. EPA

FROM: Randy Videkovich/Site Manager, CH2M HILL

RE: Aquatic Life Sampling
Laskin Poplar Oil Site

PREPARED BY: Woodward-Clyde Consultants

DATE: August 20, 1986

REVISED BY: CH2M HILL, February 25, 1988

This memorandum was prepared by Woodward-Clyde Consultants for the Phase I RI under REM/FIT Contract No. 68-01-6692, Work Assignment 32.5L03.0. It has subsequently been revised by CH2M HILL during the Phase II RI/FS. Revisions are limited to format changes.

On November 16, 1983, an attempt was made to collect fish from Cemetery Creek in an area adjacent to the Laskin Poplar Oil site using a portable shocking unit. No fish were obtained even with the equipment operating at maximum capacity. The water was observed to be very cloudy and flowing rapidly as a result of recent rainfall.

On November 17, fish were obtained from the freshwater pond. Sampling was conducted using a boat-mounted fish shocking unit. The northern (deepest) half of the freshwater pond was traversed with the fish shocking equipment running at maximum capacity. Two 3-inch-long fish were obtained and tentatively identified as bluegill. The fish were preserved by quick-freezing with dry ice and held in a freezer for future tissue analysis, if required.

The objective of this attempt to collect fish from the creek and the pond was to provide samples for tissue analysis. The fish collected may not be representative of the actual diversity of the aquatic life in either water body.

GLT777/20

Fieldwork Memorandum A-11
PHASE I RI SAMPLE MATRICES

CH2M HILL

FIELDWORK MEMORANDUM A-11

TO: Donna Twickler, U.S. EPA Project Manager

FROM: Randy Videkovich, CH2M HILL Site Manager

RE: Phase I RI Sample Matrix Tables
Laskin Poplar Oil Site

PREPARED BY: Woodward Clyde Consultants

DATE: August 20, 1986

REVISED BY: CH2M HILL, February 25, 1988

This memorandum was prepared by Woodward-Clyde Consultants for the Phase I RI under REM/FIT Contract No. 68-01-6692, Work Assignment 32.5L03.0. It has subsequently been revised by CH2M HILL during the Phase II RI/FS. Revisions are limited to format changes.

The sample matrix tables cross reference the sample numbers used in the RI/FS with the inorganic and organic traffic report numbers, case number, and laboratories to which the samples were shipped. They allow the user to quickly identify the data received from the Contract Laboratory Program.

The Phase I RI sample numbering system assigned the location identifier and a number identifying the specific sample collected at the location. For example, the surface soil sample at location SN015 (see Table A-11-2, Page 2 of 3) was assigned the sample identifiers, SN015-001 for inorganic constituent analysis and SN015-002 for organic compound analysis. Another example is the subsurface soil sample at location SN001. The sample numbers SN001-021 indicate the inorganic constituent sample and SN001-022 organic compound samples. The depths at which the subsurface soil samples were collected are given on the boring logs in Fieldwork Memorandum A-1.

SAMPLE IDENTIFICATION MATRICES

GLT777/49

Table A-11-1
SAMPLE IDENTIFICATION MATRIX
BOILER STACK (BS)

Inorganic Case No.--759S Lab--CMT		Organic Case No.--759S Lab--IT/WCTS	
WCC No.	Sample	WCC No.	Sample
BS001A-001	5-109301	BS001A-002	B-1A-2
BS001B-001	5-109304	BS001B-002	B-1B-2
BS002A-001	5-109307	BS002A-002	B-2A-2
BS002B-001	5-109310	BS002B-002	B-2B-2
BS003A-001	5-109313	BS003A-002	B-3A-2
BS003B-001	5-109316	BS003B-002	B-3B-2
BS004-001	5-109319	BS004-002	B-4-2
BS004-004 DUP	5-109322	BS004-005 DUP	B-4-5
BS005-001	5-48200	BS005-002	B-5-2
BS005-004 DUP	5-48203	BS005-005 DUP	B-5-5
BS005-007 BLANK	5-109325	BS005-008 BLANK	B-5-8

CHLORODIBENZO-(P-DIOXINS)/(FURANS)
CASE NO.--759S
LAB--CAL

WCC No.	Lab No.
BS001A-003	T1864
BS001B-003	T1865
BS002A-003	T1866
BS002B-003	T1867
BS003A-003	T1868
BS003B-003	T1869
BS004-003	T1870
BS004-006 DUP	T1871
BS005-003	T1921
BS005-006 DUP	T1922
BS005-009 BLANK	T1872

NOTES:

IT/WCTS--IT/West Coast Technical Services, Inc.
CMT-- Chem Tech Corporation
CAL-- California Analytical Laboratories, Inc.

GLT777/44

Table A-11-2 (Page 1 of 3)
SAMPLE IDENTIFICATION MATRIX
ONSITE SOIL (SN)

	Inorganic				Organic		
WCC No.	ITR	Case No.	Lab	WCC No.	OTR	Case No.	Lab
SN001-003	MS0733	2096	Versar	SN001-004	S2913	2096	IT/WCTS
SN001-021	MS0734			SN001-022	S2914		
SN001-047	MS0735			SN001-048	S2915		
SN001-059	MS0736			SN001-060	S2916		
SN001-063	MS0737			SN001-064	S2917		
SN002-003	MS0743			SN002-004	S2923		
SN002-017	MS0721			SN002-018	S2901		
SN002-043	MS0722			SN002-044	S2902		
SN002-045 DUP	MS0723			SN002-046 DUP	S2903		
SN002-057	MS0724			SN002-058	S2904		
SN002-063	MS0725			SN002-064	S2905		
SN003-003	MS0726			SN003-004	S2906		
SN003-017	MS0727			SN003-018	S2907		
SN003-041	MS0728			SN003-042	S2908		
SN003-043 DUP	MS0729			SN003-044 DUP	S2909		
SN003-045 BLANK	MS0730			SN003-046 BLANK	S2910		
SN003-057	MS0731			SN003-058	S2911		
SN003-073	MS0732			SN003-074	S2912		
SN004-003	MS0738			SN004-004	S2918		
SN004-019	MS0739			SN004-020	S2919		
SN004-039	MS0740			SN004-040	S2920		
SN004-059	MS0741			SN004-060	S2921		
SN004-073	MS0742			SN004-074	S2922		
SN006-003	MS0869	2184	UST	SN006-004	S3049	2184	Mead
SN006-009	MS0870			SN006-010	S3050		
SN006-023	MS0871			SN006-024	S3051		
SN006-033	MS0872			SN006-034	S3052		
SN006-041	MS0873			SN006-042	S3053		
SN006-043 DUP	MS0874			SN006-044 DUP	S3054		
SN007-003	MS0875			SN007-004	S3055		
SN007-011	MS0876			SN007-012	S3056		
SN007-024	MS0877			SN007-023	S3057		
SN007-034	MS0878			SN007-033	S3058		
SN007-039	MS0879			SN007-040	S3059		
SN007-041 BLANK	MS0880			SN007-042 BLANK	S3060		
SN008-003	MS0885			SN008-004	S3065		
SN008-009	MS0886			SN008-010	S3066		
SN008-023	MS0887			SN008-024	S3067		

Table A-11-2 (Page 2 of 3)

	Inorganic				Organic		
WCC No.	ITR	Case No.	Lab	WCC No.	OTR	Case No.	Lab
SN008-033	MS0888	2184	UST	SN008-034	S3068	2184	Mead
SN008-041	MS0889			SN008-042	S3069		
SN008-043 DUP	MS0890			SN008-044 DUP	S3070		
SN009-003	MS0910			SN009-004	S3090		
SN009-009	MS0911			SN009-010	S3091		
SN009-023	MS0912			SN009-024	S3092		
SN009-033	MS0913			SN009-034	S3093		
SN009-041	MS0914			SN009-042	S3094		
SN009-043 DUP	MS0915			SN009-044 DUP	S3095		
SN010-003	MS0942			SN010-004	S2816		
SN010-009	MS0943			SN010-010	S2817		
SN010-023	MS0944			SN010-024	S2818		
SN010-033	MS0945			SN010-034	S2819		
SN010-041	MS0946			SN010-042	S2820		
SN010-043 DUP	MS0947			SN010-044 DUP	S2821		
SN010-045 BLANK	MS0948			SN010-046 BLANK	S2822		
SN011-003	MS0949			SN011-004	S2823		
SN011-011	MS0950			SN011-012	S3149		
SN011-023	MS0951			SN011-024	S3150		
SN011-033	MS0952			SN011-034	S3151		
SN011-041	MS0953			SN011-042	S3152		
SN011-045 BLANK	MS0954			SN011-046 BLANK	S3153		
SN012-003	MS0955			SN012-004	S3154		
SN012-007	MS0956			SN012-008	S3155		
SN012-013	MS0957			SN012-014	S3156		
SN012-019	MS0958			SN012-020	S3157		
SN012-027	MS0959			SN012-028	S3158		
SN012-033	MS0960			SN012-034	S3159		
SN012-041	MS0961			SN012-042	S3160		
SN012-043 DUP	MS0962			SN012-044 DUP	S3161		
SN012-049	MS0963			SN012-050	S3162		
SN012-055	MS0964			SN012-056	S3163		
SN012-071	MS0965			SN012-072	S3164		
SN013-001	MS1406	2271	UST	SN013-002	S3586	2271	Mead
SN014-001	MS1400			SN014-002	S3580		
SN015-001	MS1401			SN015-002	S3581		

Table A-11-2 (Page 3 of 3)

	Inorganic				Organic		
WCC No.	ITR	Case No.	Lab	WCC No.	OTR	Case No.	Lab
SN016-001	MS1402	2271	UST	SN016-002	S3582	2271	Mead
SN016-003 DUP	MS1403			SN016-004 DUP	S3583		
SN016-005 BLANK	MS1404			SN016-006 BLANK	S3584		
SN017-001	MS1405			SN017-002	S3585		

CHLORODIBENZO-(P-DIOXINS)/(FURANS)
CASE NO.--85HR02
SAS NO.--1750-E
LAB--MRI & AATS*

WCC No.	SAS Sample No.
SN018-001	1750E01
SN018-002 DUP	1750E02
SN019-001	1750E03
SN019-002 DUP	1750E04
SN020-001	1750E05
SN021-001	1750E06

NOTES:

ITR-- Inorganic Traffic Report Number
OTR-- Organic Traffic Report Number
SAS-- Special Analytical Services
Versar-- Versar, Inc.
IT/WCTS--IT/West Coast Technical Services, Inc.
Mead-- Mead Compu Chem Laboratory
MRI-- Midwest Research Institute
AATS-- American Analytical and Technical Services, Inc.
UST-- United States Testing Laboratory Company, Inc.

*Samples were initially submitted to MRI for analysis. MRI test results were unacceptable based on QA/QC validation of data. Remainder of samples were submitted to ATTS for subsequent analysis.

Table A-11-3
SAMPLE IDENTIFICATION MATRIX
WET WEATHER (WW)

	Inorganic				Organic		
WCC No.	ITR	Case No.	Lab	WCC No.	OTR	Case No.	Lab
WW001-001	MS0974	2184	UST	WW001-002	S3173	2184	Mead
WW002-001	MS0975			WW002-002	S3174		
WW002-005 DUP	MS0976			WW002-004 DUP	S3175		
WW002-007 BLANK	MS0977			WW002-008 BLANK	S3176		
WW003-001	MS0978			WW003-002	S3177		

OIL AND GREASE

WCC No.	CAL. I.D.	Case No.	Lab
WW001-003	S3731	759S	CAL
WW002-003	S3732		
WW002-006 DUP	S3733		
WW002-009 BLANK	S3734		
WW003-003	S3735		

NOTES:

ITR-- Inorganic Traffic Report Number
OTR-- Organic Traffic Report Number
CAL. I.D.--Laboratory Identification Number
Mead-- Mead Compu Chem Laboratory
UST-- United States Testing Laboratory Company, Inc.
CAL-- California Analytical Laboratories, Inc.

GLT777/46

Table A-11-4
SAMPLE IDENTIFICATION MATRIX
SURFACE WATER (SW)

	Inorganic				Organic		
WCC No.	ITR	Case No.	Lab	WCC No.	OTR	Case No.	Lab
SW001-001	MS0744	2184	UST	SW001-002	S2924	2184	Mead
SW002-001	MS0745			SW002-002	S2925		
SW002-003 DUP	MS0746			SW002-004 DUP	S3041		
SW002-005 BLANK	MS0747			SW002-006 BLANK	S3042		
SW003-001	MS0863			SW003-002	S3043		
SW004-001	MS0864			SW004-002	S3044		
SW005-001	MS0865			SW005-002	S3045		
SW005-005 DUP	MS0866			SW005-004 DUP	S3046		
SW005-007 BLANK	MS0867			SW005-008 BLANK	S3047		
SW006-001	MS0868			SW006-002	S3048		
SW007-001	MS1380	2271	UST	SW007-002	S3559	2271	Mead
SW007-005 DUP	MS1381			SW007-004 DUP	S3560		
SW007-007 BLANK	MS1382			SW007-008 BLANK	S3561		
SW008-001	MS1383			SW008-002	S3562		
SW009-001	MS1384			SW009-002	S3563		

OIL AND GREASE

WCC No.	CAL. I.D.	Case No.	Lab
SW005-003	S3647	7595	CAL
SW005-006 DUP	S3648		
SW005-009 BLANK	S3649		
SW006-003	S3650		
SW007-003	S3752		
SW007-006 DUP	S3753		
SW007-009 BLANK	S3756		
SW008-003	S3754		
SW009-003	S3755		

NOTES:

ITR-- Inorganic Traffic Report Number
OTR-- Organic Traffic Report Number
CAL. I.D.--Laboratory Identification Number
Mead-- Mead Compu Chem Laboratory
UST-- United States Testing Laboratory Company, Inc.
CAL-- California Analytical Laboratories, Inc.

Table A-11-5
SAMPLE IDENTIFICATION MATRIX
SEDIMENT (SD)

Inorganic				Organic			
WCC No.	ITR	Case No.	Lab	WCC No.	OTR	Case No.	Lab
SD001A-001	MS1385	2271	UST	SD001A-002	S3565	2271	Mead
SD001B-001	MS1386			SD001B-002	S3566		
SD001B-003	MS1387			SD001B-004	S3567		
SD001C-001	MS1388			SD001C-002	S3568		
SD002A-001	MS1389			SD002A-002	S3569		
SD002B-001	MS1390			SD002B-002	S3570		
SD002B-007 DUP	MS1391			SD002B-008 DUP	S3571		
SD002B-009 BLANK	MS1392			SD002B-010 BLANK	S3572		
SD002C-001	MS1393			SD002C-002	S3573		
SD003A-001	MS1394			SD003A-002	S3574		
SD003B-001	MS1395			SD003B-002	S3575		
SD003C-001	MS1396			SD003C-002	S3576		
SD004A-001	MS1397			SD004A-002	S3577		
SD004B-001	MS1398			SD004B-002	S3578		
SD004C-001	MS1399			SD004C-002	S3579		
SD005-001	MS0881	2184	UST	SD005-002	S3061	2184	Mead
SD005-004 DUP	MS0883			SD005-005 DUP	S3063		
SD005-007 BLANK	MS0884			SD005-008 BLANK	S3064		
SD006-001	MS0882			SD006-002	S3062		
SD007-001	MS1407	2271	UST	SD007-002	S3587	2271	Mead
SD007-004 DUP	MS1408			SD007-005 DUP	S3588		
SD007-007 BLANK	MS1409			SD007-008 BLANK	S3589		
SD008-001	MS1410			SD008-002	S3590		
SD009-001	MS1411			SD009-002	S3591		

OIL AND GREASE

WCC No.	CAL I.D.	Case No.	Lab
SD005-003	S3666	759S	CAL
SD005-006 DUP	S3667		
SD005-009 BLANK	S3668		
SD006-003	S3669		
SD007-003	S3808		
SD007-006 DUP	S3809		
SD007-009 BLANK	S3810		
SD008-003	S3811		
SD009-003	S3812		

NOTES:
ITR-- Inorganic Traffic Report Number
OTR-- Organic Traffic Report Number
CAL I.D.--Laboratory Identification Number
Mead-- Mead Compu Chem Laboratory
UST-- United States Testing Laboratory Company, Inc.
CAL-- California Analytical Laboratories, Inc.

Table A-11-6
SAMPLE IDENTIFICATION MATRIX
GROUNDWATER (GW)

	Inorganic				Organic		
WCC No.	ITR	Case No.	Lab	WCC No.	OTR	Case No.	Lab
GW001-001	MS1369	2271	UST	GW001-002	S3549	2271	Mead
GW002-001 BLANK	MS1370			GW002-002 BLANK	S3550		
GW002-003 DUP	MS1372			GW002-004 DUP	S3552		
GW002-005	MS1373			GW002-006	S3553		
GW004-001	MS1374			GW004-002	S3554		
GW005-001	MS1375			GW005-002	S3555		

NOTES:

ITR--Inorganic Traffic Report Number
OTR--Organic Traffic Report Number
Mead--Mead Compu Chem Laboratory
UST-- United States Testing Laboratory Company, Inc.
D-- Duplicate Sample
B-- Blank Sample

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Table A-11-7 (Page 1 of 2)
SAMPLE IDENTIFICATION MATRIX
OFFSITE SURFACE SOIL (SF)

	Inorganic				Organic		
WCC No.	ITR	Case No.	Lab	WCC No.	OTR	Case No.	Lab
SF001-001	MS0891	2184	UST	SF001-002	S3071	2184	Mead
SF002-001	MS0892			SF002-002	S3072		
SF002-003 DUP	MS0893			SF002-004 DUP	S3073		
SF002-005 BLANK	MS0894			SF002-006 BLANK	S3074		
SF003-001	MS0895			SF003-002	S3075		
SF004-001	MS0896			SF004-002	S3076		
SF005-001	MS0897			SF005-002	S3077		
SF006-001	MS0898			SF006-002	S3078		
SF007-001	MS0899			SF007-002	S3079		
SF008-001	MS0900			SF008-002	S3080		
SF009-001	MS0901			SF009-002	S3081		
SF010-001	MS0902			SF010-002	S3082		
SF011-001	MS0903			SF011-002	S3083		
SF012-001	MS0904	2271	UST	SF012-002	S3084	2271	Mead
SF013-001	MS0905			SF013-002	S3085		
SF013-003 DUP	MS0906			SF013-004 DUP	S3086		
SF014-001	MS0907			SF014-002	S3087		
SF015-001	MS0908			SF015-002	S3088		
SF016-001	MS0909			SF016-002	S3089		

CHLORODIBENZO-(P-DIOXINS)/(FURANS)
CASE NO.--85HR01
SAS NO.--1383-E
LAB--WSU

WCC No.	SAS Sample no.
SF005-003	1383-E-1
SF006-003	1383-E-2
SF013-005	1383-E-3
SF014-003	1383-E-4
SF017-001	1383-E-5
SF018-001	1383-E-6
SF019-001	1383-E-7
SF019-002 DUP	1383-E-8
SF019-003 BLANK	1383-E-9

Table A-11-7 (Page 2 of 2)
SAMPLE IDENTIFICATION MATRIX
OFFSITE SURFACE SOIL (SF)

BACKGROUND SOIL SAMPLES
CASE NO.--4526
SAS NO. 1764E

	Inorganic			Organic	
WCC No.	ITR	Lab	WCC No.	OTR	Lab
SF020-001	MEB681	RMAL			
SF021-001	MEB682				
SF021-003 DUP	MEB683				
SF022-001	MEB684		SF022-002	E9641	CEI
SF023-001	MEB685		SF022-004 DUP	E8798	
SF024-001	MEB686		SF024-002	E8799	
SF025-001	MEB687		SF024-004 DUP	E9642	
SF025-003 DUP	MEB688				

NOTES:

ITR--Inorganic Traffic Report Number
OTR--Organic Traffic Report Number
SAS--Special Analytical Services
Mead--Mead Compu Chem Laboratory
UST--United States Testing Laboratory Company, Inc.
WSU--Wright State University, Brehm Laboratory
RMAL--Rocky Mountain Analytical Laboratory
CEI-- Combustion Engineering Inc. (Environmental Monitoring and Services, Inc.)
D-- Duplicate Sample
B-- Blank Sample

GLT777/42

Table A-11-8
SAMPLE IDENTIFICATION MATRIX
ROAD OIL (RD)

	Inorganic				Organic		
WCC No.	ITR	Case No.	Lab	WCC No.	OTR	Case No.	Lab
RD001-001	MS0966	2271	UST	RD001-002	S3165	2271	Mead
RD001-003	MS0967			RD001-004	S3166		
RD002-001	MS0968			RD002-002	S3167		
RD002-003	MS0969			RD002-004	S3168		
RD002-005 DUP	MS0971			RD002-006 DUP	S3169		
RD002-007 BLANK	MS0970			RD002-008 BLANK	S3170		
RD003-001	MS0972			RD003-002	S3171		
RD003-003	MS0973			RD003-004	S3172		
RD004-001	MS0979			RD004-002	S3178		
RD004-003	MS0980			RD004-004	S3179		
RD005-001	MS0981			RD005-002	S3180		
RD005-003	MS0982			RD005-004	S3181		
RD006-001	MS0983			RD006-002	S3182		
RD007-001	MS0916			RD007-002	S3184		
RD007-003	MS0917			RD007-004	S3185		
RD008-001	MS0918			RD008-002	S3186		
RD008-003	MS0919			RD008-004	S3187		
RD009-001	MS0985			RD009-002	S3188		
RD009-003	MS0986			RD009-004	S3189		
RD009-005 DUP	MS0987			RD009-006 DUP	S3190		
RD010-001	MS0988			RD010-002	S3191		
RD010-003	MS0989			RD010-004	S3192		

NOTES:

ITR-- Inorganic Traffic Report number
OTR-- Organic Traffic Report Number
Mead--Mead Comp Chem Laboratory
UST-- United States Testing Laboratory Company, Inc.

Appendix B
PHASE II FIELDWORK MEMORANDUMS

Fieldwork Memorandum B-1
GEOPHYSICS

CH2M HILL

FIELDWORK MEMORANDUM B-1

TO: Donna Twickler, U.S. EPA, Remedial Project Manager

FROM: Randy Videkovich, CH2M HILL, Site Manager

PREPARED BY: Don Johnson, CH2M HILL

DATE: February 22, 1988

RE: Phase II RI Geophysics
Laskin Poplar Oil Site
EPA WA 132-5N03

PROJECT: W68792.FP

INTRODUCTION

Seismic refraction and magnetometer surveys were performed at the Laskin Poplar Oil Site between November 11 and 18, 1987. The surveys were performed by Don Johnson with the assistance of Bob Weinschrott, both from CH2M HILL.

The Phase II RI Work Plan had identified several data gaps in the existing hydrogeologic interpretation, among them being the interaction between the freshwater pond and the groundwater. Specifically, it was unknown if the freshwater pond was connected to the bedrock. A seismic survey performed during the Phase I RI to identify depth to bedrock around the pond had several apparent misinterpretations due to inconsistencies within the Phase I RI geophysical results and also between those results and what was already known about the site. Reinterpretation was impossible because the raw data were lost. The Phase II RI geophysical study helped determine the hydraulic connection between the fresh water pond and the bedrock by determining the bedrock depth.

SCOPE

The Phase II RI Work Plan proposed a seismic survey along all sides of the freshwater pond (Figure B-1-1). A seismic survey was also performed north of the retention pond during the same period. The survey data were used in conjunction with the boring logs to identify the depth to bedrock. A magnetometer survey was proposed to identify buried objects that would cause difficulties during the proposed drilling. The proposed survey covered the onsite drilling areas.

SEISMIC SURVEY

EQUIPMENT AND METHOD

The Geometrics Model ES1225 seismograph used for the seismic data collection was a 12-channel signal enhancement system. A 20-foot spacing geophone cable was used. A downhole seismic tool was used as the seismic energy source.

The seismic survey was performed by planting 12 geophones in the ground at a set interval along a straight line. The geophones were connected to the seismograph with the geophone cable. Each of these setups constituted a spread. Spreads that were end-to-end were referred to as a seismic line.

Up to five shot points were used with each spread. Energy was imparted into the ground at each shot point by detonating a 12-gauge black powder blank 2 feet below the ground surface in a shothole dug using a heavy iron crow bar. The shot was detonated using the downhole seismic tool. Multiple shots were used when the energy from a single shot was insufficient to obtain distinct signals. In areas where shotholes could not be dug because of the hard-packed rocky fill, the seismic signal was obtained by hammering the ground with a sledgehammer.

The geophone separation varied from spread to spread. Spreads 1 and 2 were run with 20 feet separating the geophones except for the 10-foot interval between geophones 1 and 2, 2 and 3, 10 and 11, and 11 and 12. This allowed for increased resolution near the ends of the spreads. Spreads 3 through 11 were run with 10 feet separating the geophones except for between geophones 1 and 2 and 11 and 12 where a 5-foot separation was used. This permitted a higher overall resolution. Spreads 12 and 13 were run using 20-foot separations with 10 feet separating geophones 1 and 2, and 11 and 12. Greater depths to bedrock were anticipated at this locations so the larger geophone separation was needed.

The times of the first arrivals at each geophone were measured on the seismograph's display screen. A permanent paper copy of the seismic record was also obtained from the seismograph's printer.

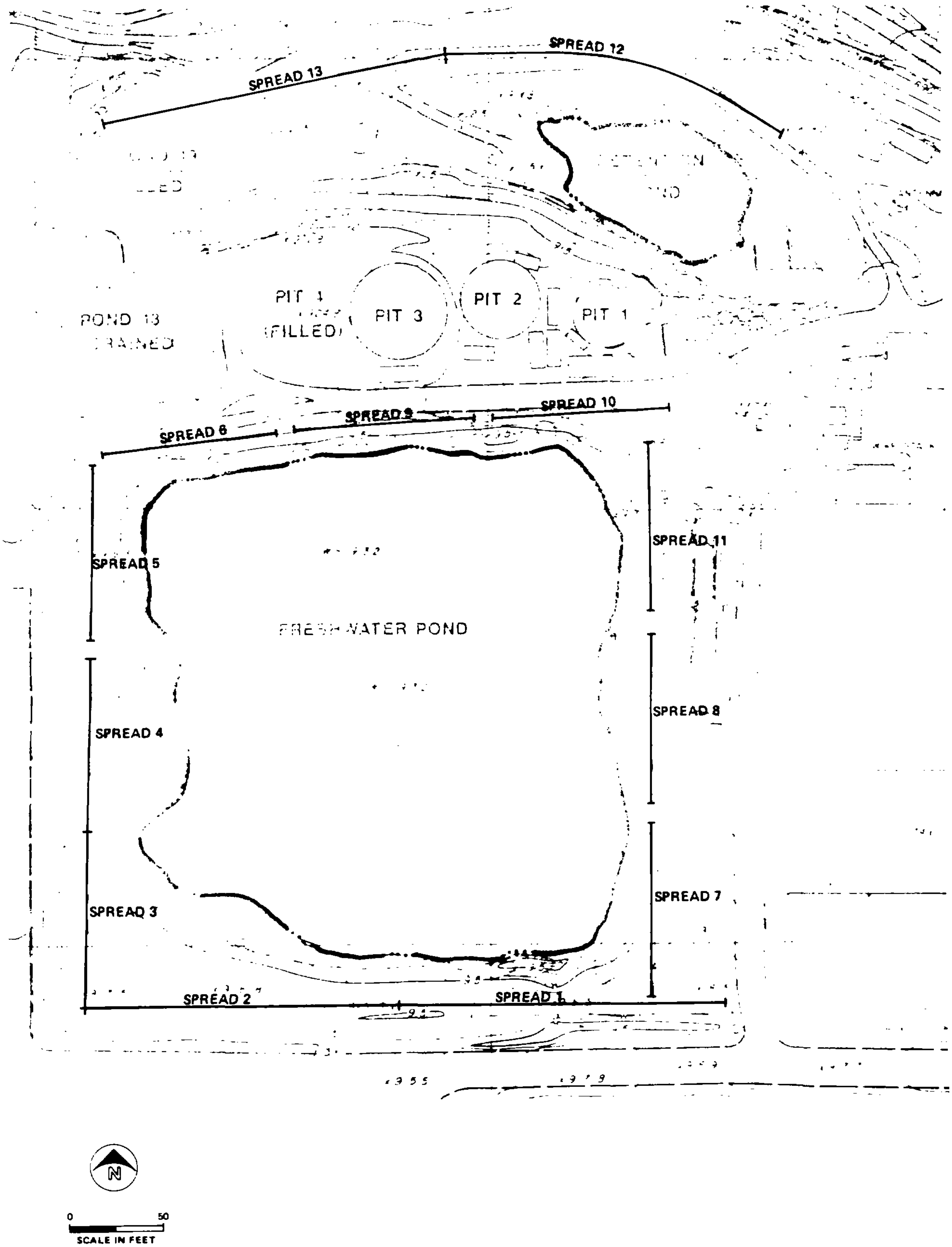


FIGURE B-1-1
SEISMIC SPREAD LOCATIONS
LASKIN POPLAR

Retention Pond Line

Spreads 12 and 13 make up this line. Layer 1 averages 2 to 3 feet thick and is reasonably uniform. Bedrock depths are greater in the center of the line than at the ends and probably reflect the buried ravine. Bedrock is at depth of about 25 feet at the west end of the line, 45 feet in the center and 30 feet at the east end.

MAGNETICS

EQUIPMENT AND METHOD

The Geonics Model G846 magnetometer used for the collection of magnetic data is a proton precession magnetometer that measures the total magnetic field. The sensor was mounted on a 6-foot nonmagnetic staff. The magnetometer was carried by means of a shoulder strap, and was kept at arm's length from the sensor.

The survey was performed by taking measurements at 10-foot intervals along grid lines that were 10 feet apart. In addition to the survey grid, additional data were collected along single lines along the north side of the retention pond, and along the north, west, and south sides of the freshwater pond (Figure B-1-9).

A base station was located near the center of the grid, where no anomalies were detected. A reading was taken at the base station at approximate 30-minute intervals to allow for the removal of diurnal changes to the magnetic field. The diurnal drift was negligible and no correction was needed.

Observations of visible metal were noted in the field book to help identify anomalies due to buried metal. Most anomalies were due to observed metal.

DATA VALIDATION

The primary method of data validation was the use of a base station. The normal daily change of the earth's magnetic field is less than 40 gammas. Had the periodic base station readings varied by more than this amount, then either a magnetic storm was in progress or the instrument was not functioning correctly. The base readings varied by less than 10 gammas, indicating no problems existed with the equipment.

Another validation check was to observe the total field change when a magnetic item was brought near the sensor. This effect was observed, indicating proper functioning of the equipment.

DATA INTERPRETATION

A quantitative interpretation of the magnetometer survey data was not made. (A quantitative interpretation might include modeling to better determine depth and width of the magnetic sources.) Instead, a qualitative interpretation was made that identified areas of buried and surface metal.

The first step in the interpretation was to generate a contour map from the gridded data (Figure B-1-10). Areas of anomalous magnetic values were identified as magnetic highs and lows. These areas were compared to the field notes.

The lines run outside of the gridded area were plotted as profiles (Figures B-1-11 to B-1-13). Anomalies were identified by values differing from background (approximately 54,500 gammas) by more than about 200 gammas.

RESULTS

Most anomalies were caused by visible metal at the surface, but a few were caused by buried metal (Figure B-1-14). The buried metal is not extensive and should not be a problem during drilling or excavating. The most prominent anomaly in the gridded area was over Pit 4, and was probably due to metal reinforcing bars in the pit walls. The wire fence along the north and west sides of the site did not affect data collected more than 10 feet from the fence.

Lines A and B, along the north side of the retention pond, identified buried metal near the northwest corner of the pond. The eastern end of line A was strongly influenced by adjacent metal tanks. Line C, along the north side of the freshwater pond, was also strongly influenced by nearby tanks and pits. This line was not usable for identifying buried metal. Line D did not locate any unknown buried metal, but did respond to a buried metal drain pipe and to the well casing at GW002. No metal was detected along line E.

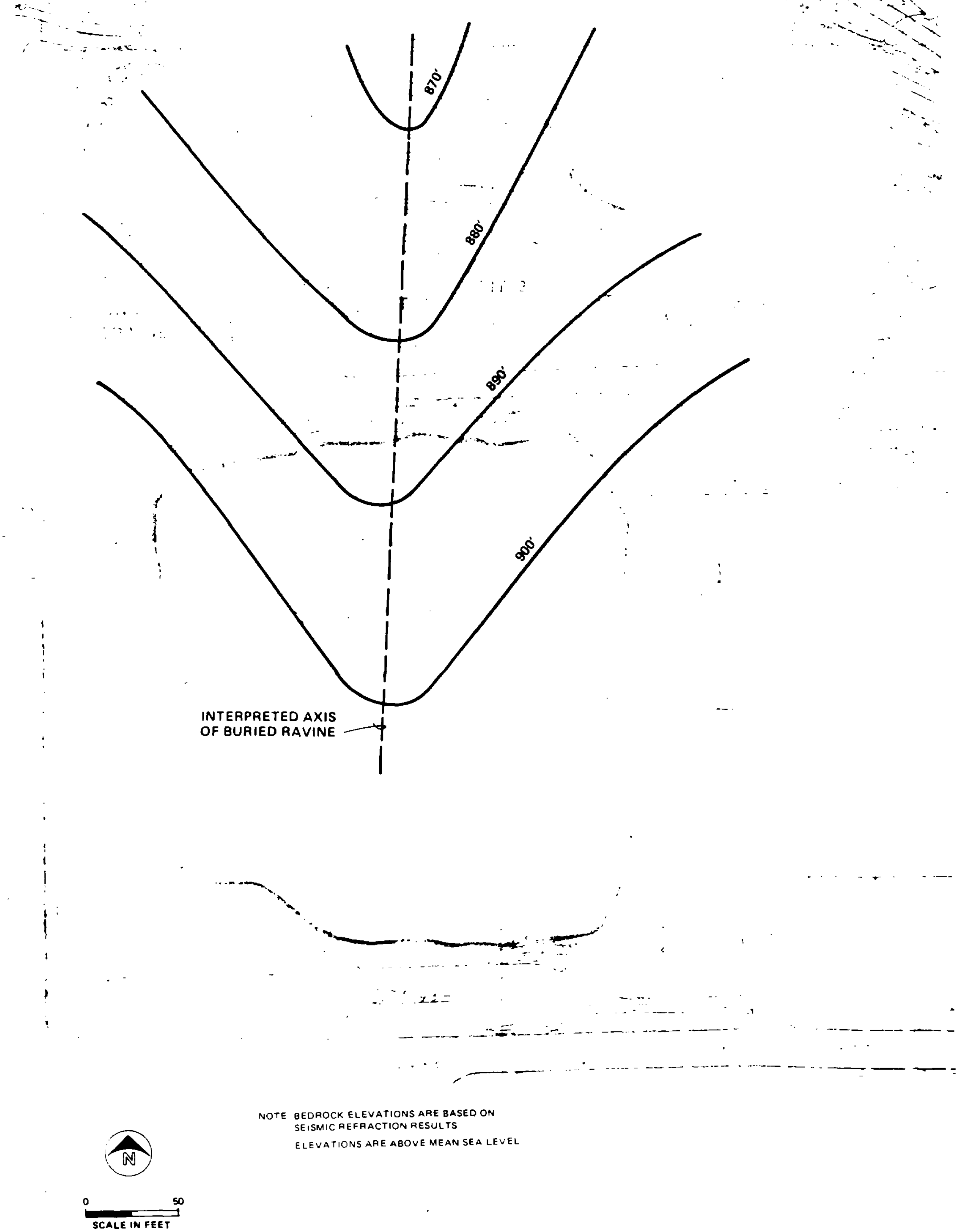


FIGURE B-1-8
INTERPRETED BEDROCK
SURFACE
LASKIN POPLAR

DATA VALIDATION

Data were evaluated each day by plotting arrival time versus distance to the shot point. The data were validated by assessing total arrival times, intercept times, and velocities, and by comparing arrival times from off-end shots and end shots (Figure B-1-2) to ensure that the arrival times were parallel.

The total time is the time for the first arrival (first wave of energy) to travel from the shot point at one end of the spread to the geophone at the other end of the spread. The total time should be the same for shots at both ends of the spread. Refracted arrivals from each layer plot along a straight line on the time-distance plot. The projection of this line intercepts the time axis (at the shot point location) at a time called the intercept time. Where the same shot point was used between spreads, the intercept time should be identical. Whenever an off-end shot is used, the arrival times from a particular layer should parallel the arrival times for the same layer from the end shot.

These methods for validating the data were performed daily and before any interpretation was made. One additional check was performed on the data after the interpretation was started. The calculated velocities for each layer at each spread were compared. These velocities should be similar, although not necessarily identical. The validation check did not identify any problems with the data. Had any problems been indicated, the data would have been reevaluated. If the problem still had not been resolved, then the spread would have been rerun.

DATA INTERPRETATION

The data interpretation involved a number of steps. The first procedure was to plot the data on time-distance plots (see Figures B-1-3 to B-1-7). At that time, the validation checks were made.

Inspection of the data indicated three layers were present at the site. Each arrival time was then associated with a particular layer. Velocities for each layer were estimated

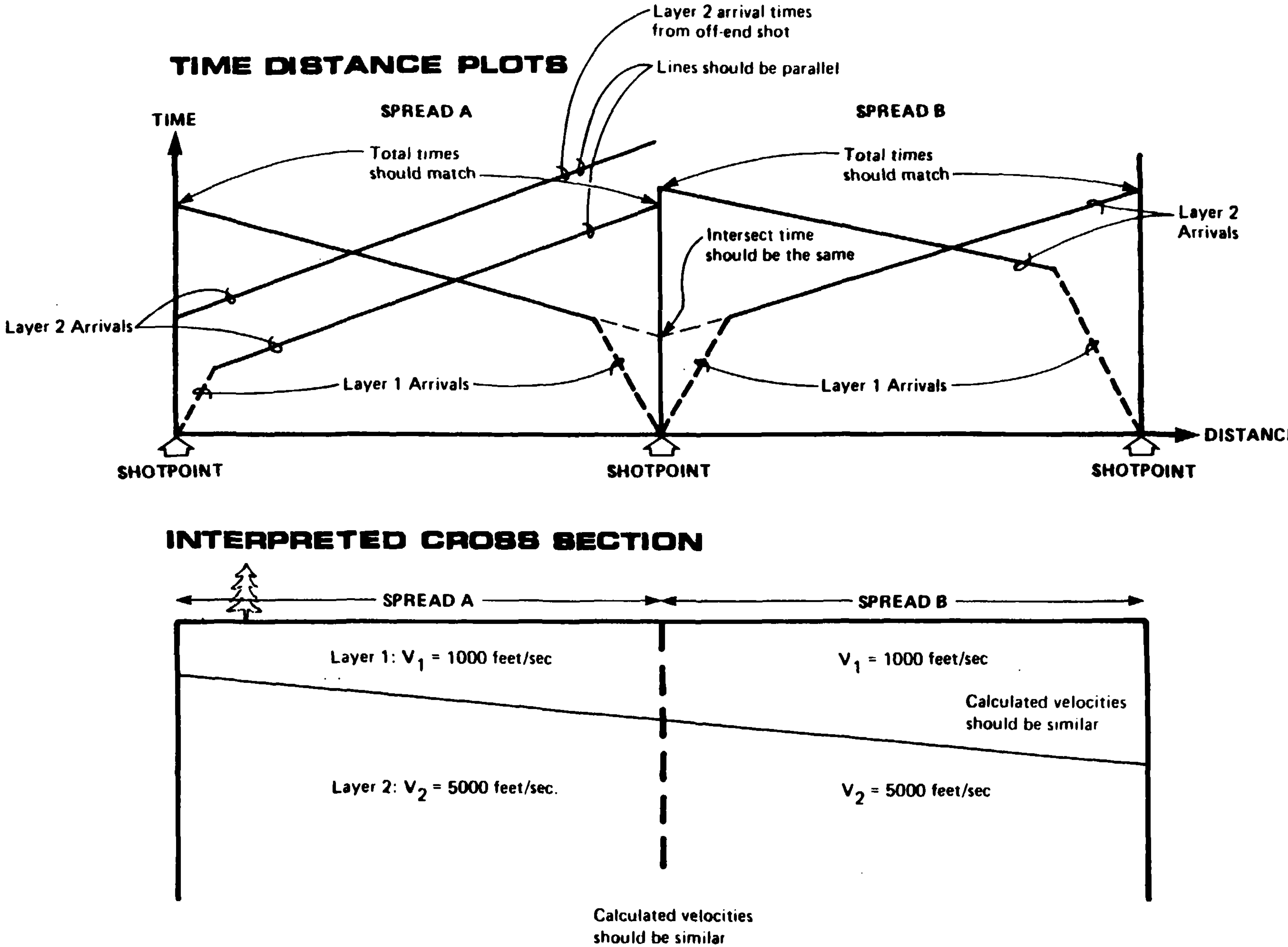


FIGURE B-1-2
VALIDITY CHECKS PERFORMED ON SEISMIC REFRACTION DATA
LASKIN POPLAR

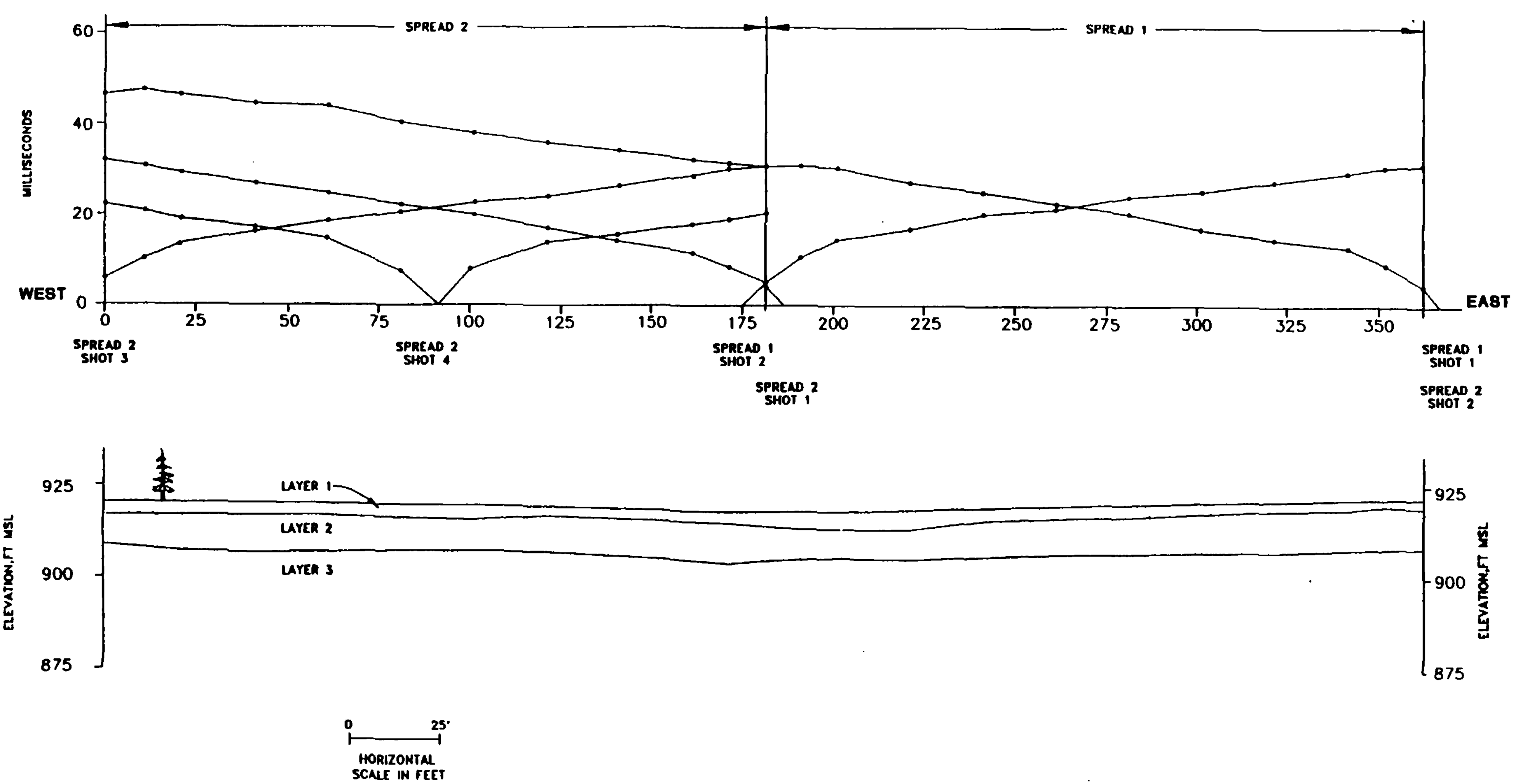


FIGURE B-1-3
SEISMIC SURVEY
SOUTH LINE
NOVEMBER 1987
LASKIN POPLAR

W68792.R2 68792G4 3/14/88

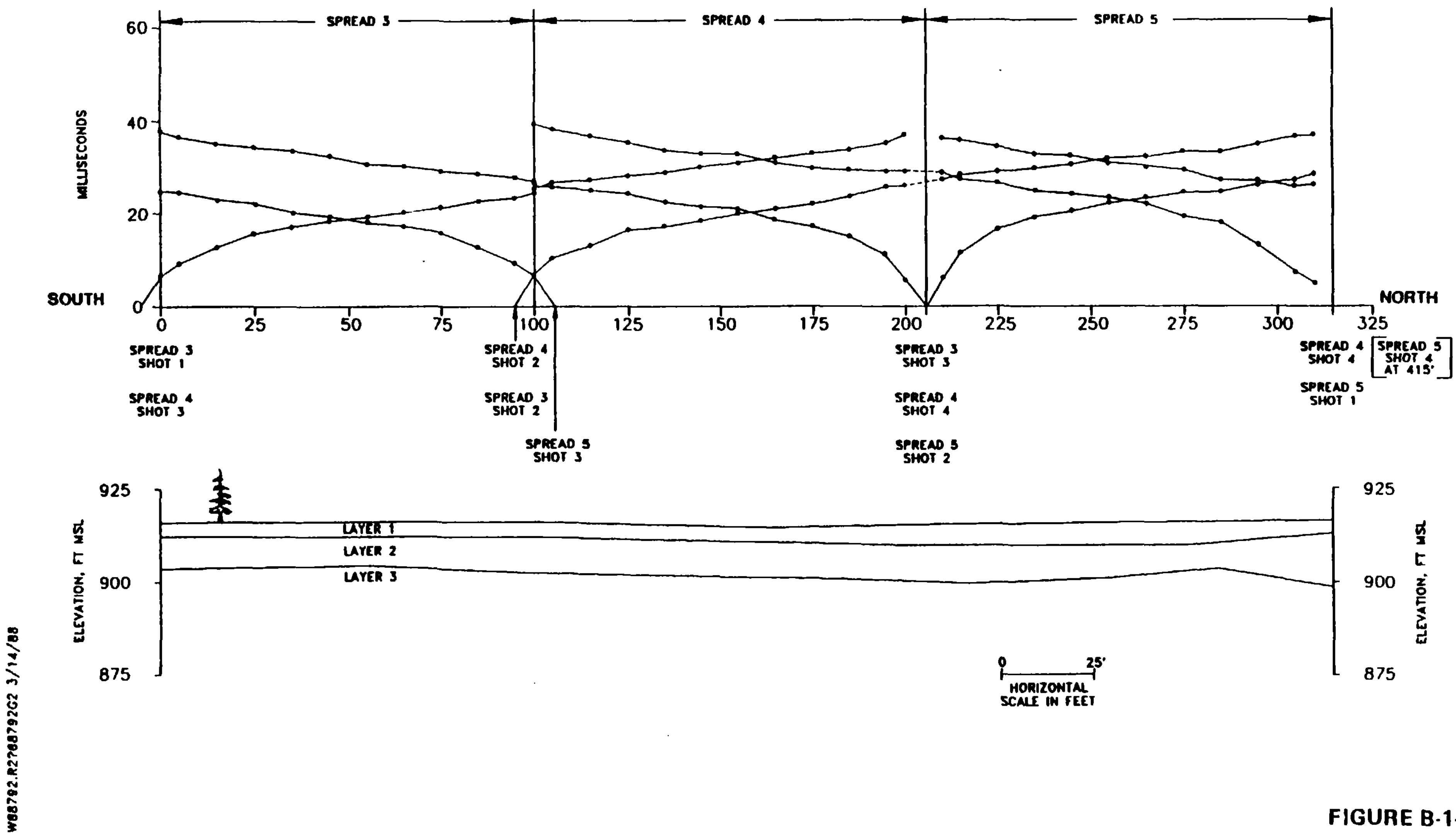


FIGURE B-1-4
SEISMIC SURVEY
WEST LINE
NOVEMBER 1987
LASKIN POPLAR

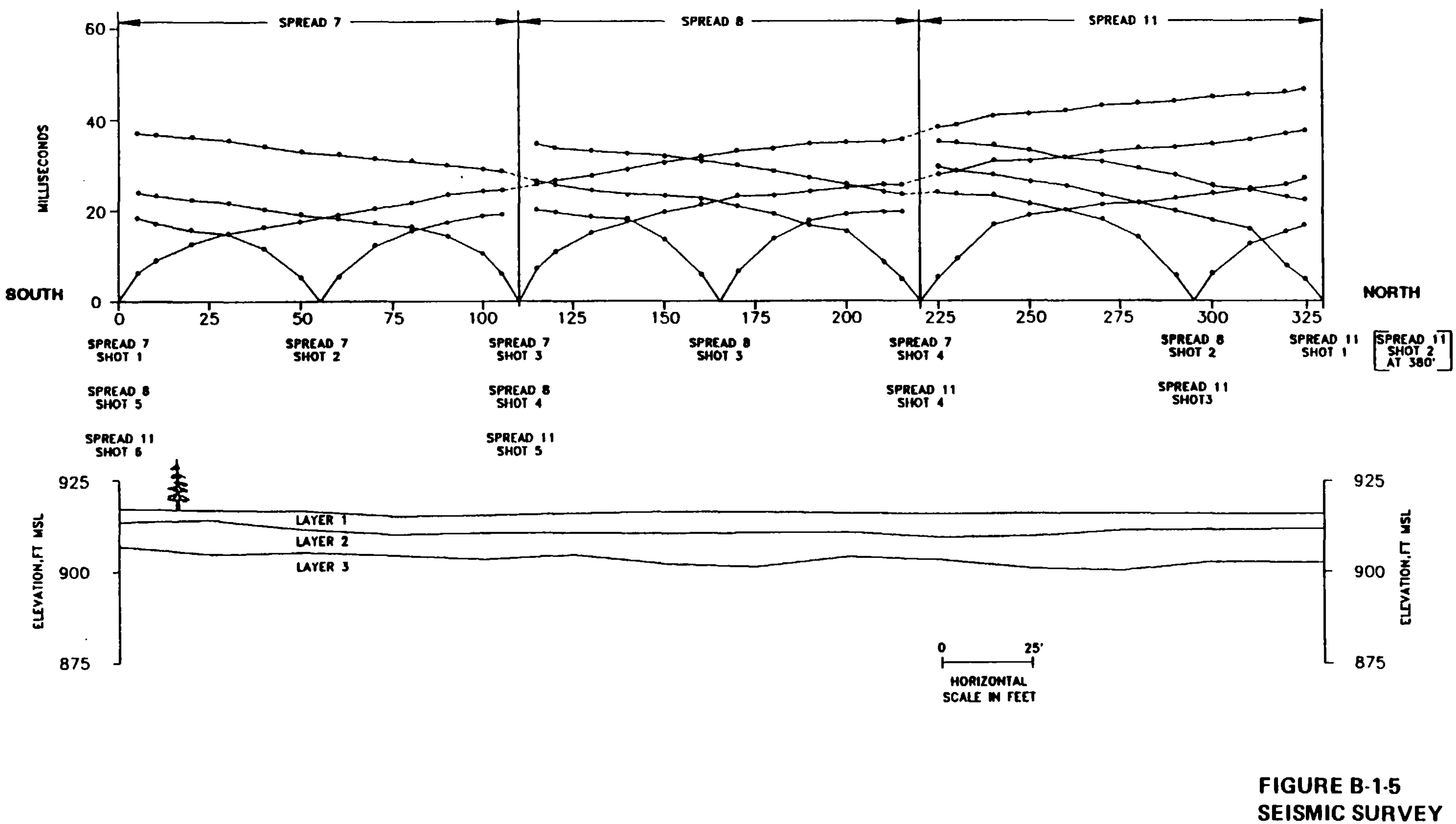
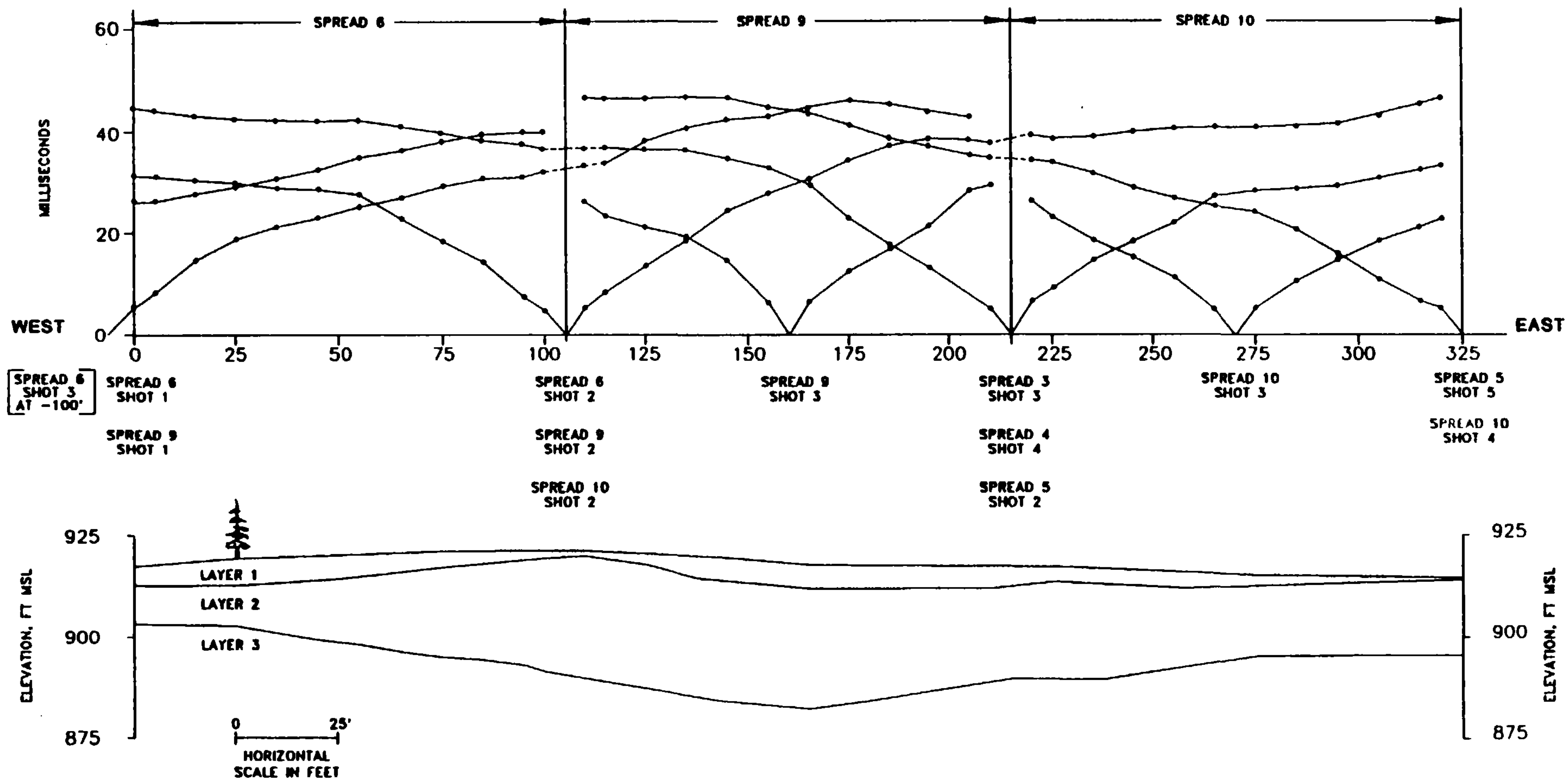
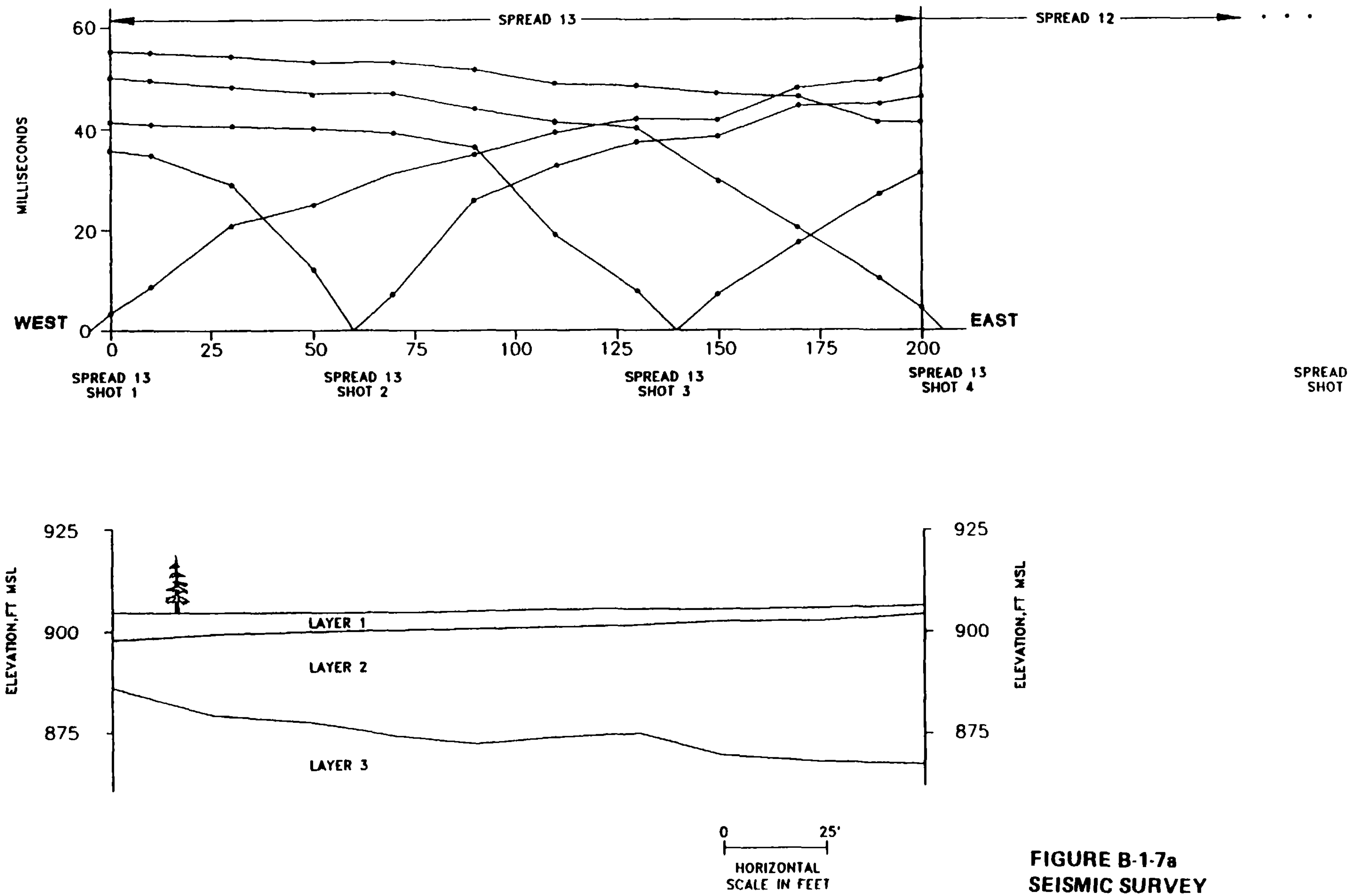


FIGURE B-1-5
SEISMIC SURVEY
EAST LINE
NOVEMBER 1987
LASKIN POPLAR



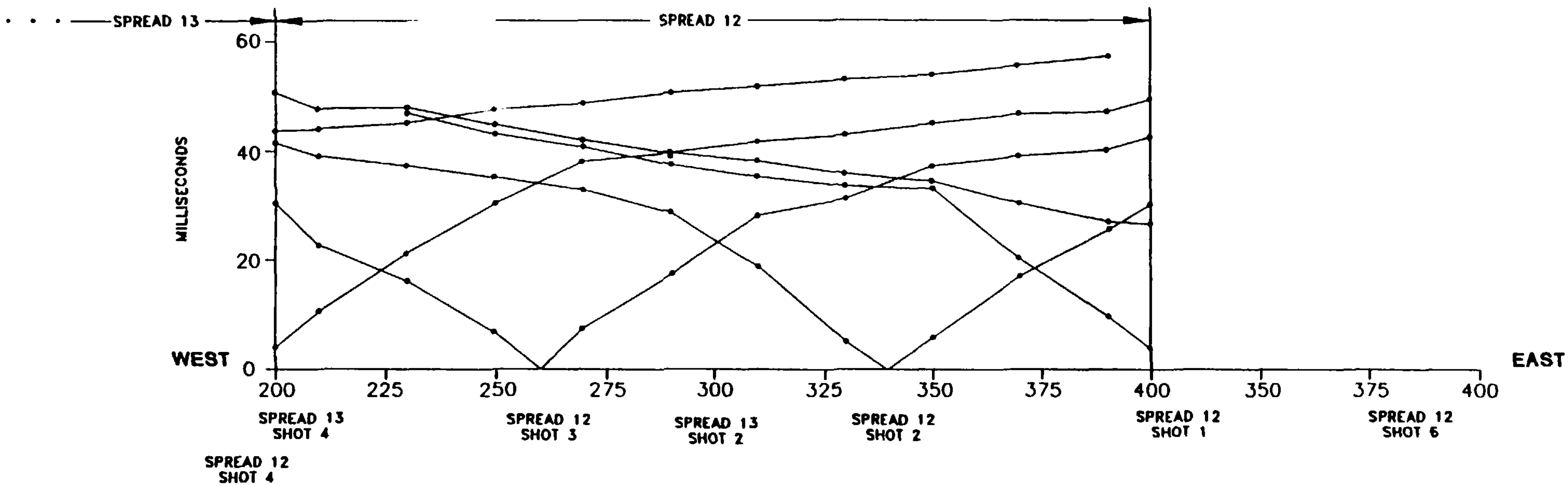
W68792.R4 68792G3 3/14/88

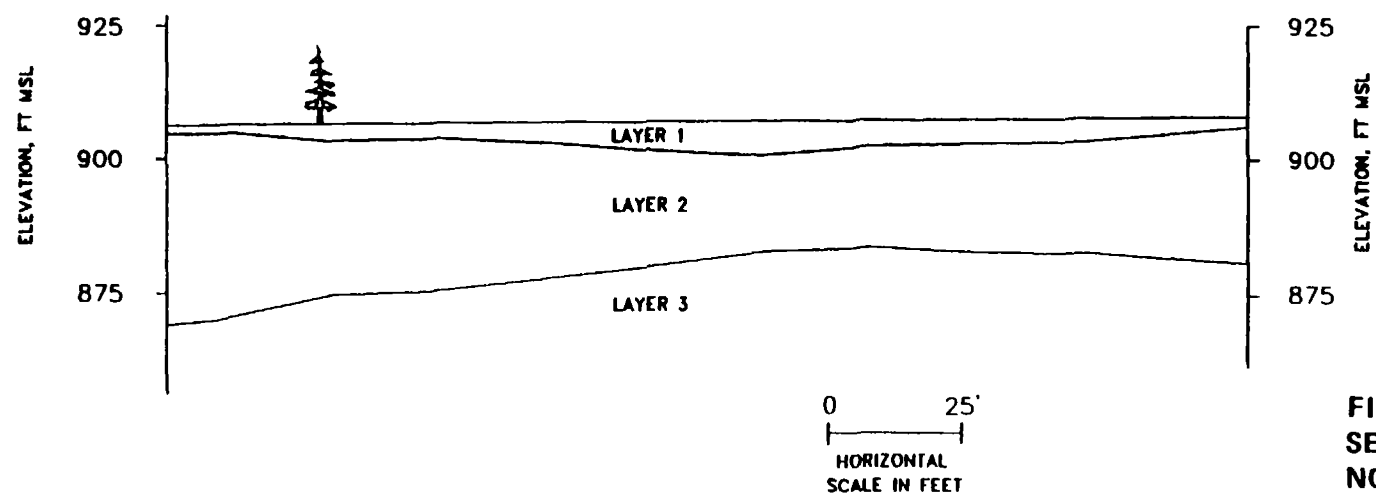
FIGURE B-1-6
SEISMIC SURVEY
NORTH LINE
NOVEMBER 1987
LASKIN POPLAR



W68792.R2 68792G5 3/15/88

FIGURE B-1-7a
SEISMIC SURVEY
NORTH OF RETENTION POND
NOVEMBER 1987
LASKIN POPLAR





W68792.R4 68792G6 3/14/88

FIGURE B-1-7b
SEISMIC SURVEY
NORTH OF RETENTION POND
NOVEMBER 1987
LASKIN POPLAR

by determining the slope of the line drawn through the arrival times associated with each layer. The calculated velocities varied little across the site so the average velocity for each layer was calculated and used in subsequent calculations.

The spread configuration, arrival times and corresponding layers, and average velocities were then used as input to a computer program. The program, called SIPT, is a program for the inverse modeling of seismic refraction data and was published in the U.S. Bureau of Mines Report of Investigations 7595. The program calculates the depths to each layer beneath each geophone and shot point. Using those depths, the program calculates the theoretical arrival time at each geophone and compares it against the observed arrival times. The program adjusts the depths to correct for discrepancies between the observed and theoretical arrival times, and repeats the cycle for a number of iterations until the discrepancies are minimized.

The output of the program is the depth to each layer beneath each geophone and shot point. Additional output allows the user to assess the computed results. Inconsistent data can be traced to specific shot points and geophones, and the user can then adjust or correct the input data as necessary.

The data were also interpreted using manual methods to determine the depth to bedrock at the spread end points. This was performed as an additional check on the computer results. Since the comparison was good, the manual results are not included in this report.

RESULTS

The seismic investigation was conducted to determine the depth to bedrock in the vicinity of the freshwater pond.

The interpreted depths are shown in Figures B-1-3 to B-1-7. Figure B-1-8 is a contour map of the bedrock surface. The bedrock contours drawn across the freshwater pond should be considered approximate because bedrock depths were calculated only around the edges of the pond.

Three layers were interpreted in the seismic data. Layer 1 is the upper layer and has a calculated velocity of 840 feet per second (ft/s) to 1,170 ft/s. A velocity of 1,000 ft/s was used for the computer calculations. This layer is interpreted to consist of unconsolidated dry surface soil and fill. Layer 2 velocities ranged from 1,560 to 3,030 ft/s and an average velocity of 2,340 ft/s was used. This layer is probably compacted soil. The third layer is bedrock, with an average velocity of 9,140 ft/s. The calculated velocity ranged from 8,660 ft/s to 10,600 ft/s. The off-end shots indicated that the bedrock velocity increased with depth. No effort was made to characterize any velocity layering within the bedrock.

South Line

The south line (Figure B-1-3) consists of Spreads 1 and 2 and was run along the south side of the freshwater pond. Layer 1 averages about 2 to 3 feet thick and layer 2 averages about 12 feet thick. The bedrock surface appears to be flat and featureless.

West Line

The west line (Figure B-1-4) is made up of Spreads 3, 4 and 5. It was run along the west side of the freshwater pond. Layer 1 is 3 to 4 feet thick on the southern half of the line and 5 to 6 feet thick on the northern half. Bedrock averages 12 to 13 feet beneath the surface and is generally flat except for a slight high near the northern end of the line.

East Line

This line consists of Spreads 7, 8 and 11 (Figure B-1-5) and was run along the east side of the freshwater pond. Layer 1 averages about 5 feet thick. The bedrock depth increases slightly to the north. It is about 10 feet below the surface at the south end and increases to 15 feet below the surface at places near the north end.

North Line

Spreads 6, 9 and 10 make up the north line (Figure B-1-6), along the north side of the freshwater pond. Layer 1 varies from about 2 feet thick to 5 feet thick. The range in thickness probably reflects the variability of the till along the north side of the pond. Bedrock depths at each end of the line is from 15 to 20 feet deep. At the center of the line, bedrock is at a depth of about 35 feet. The thickening of the soils is thought to be due to a buried ravine.

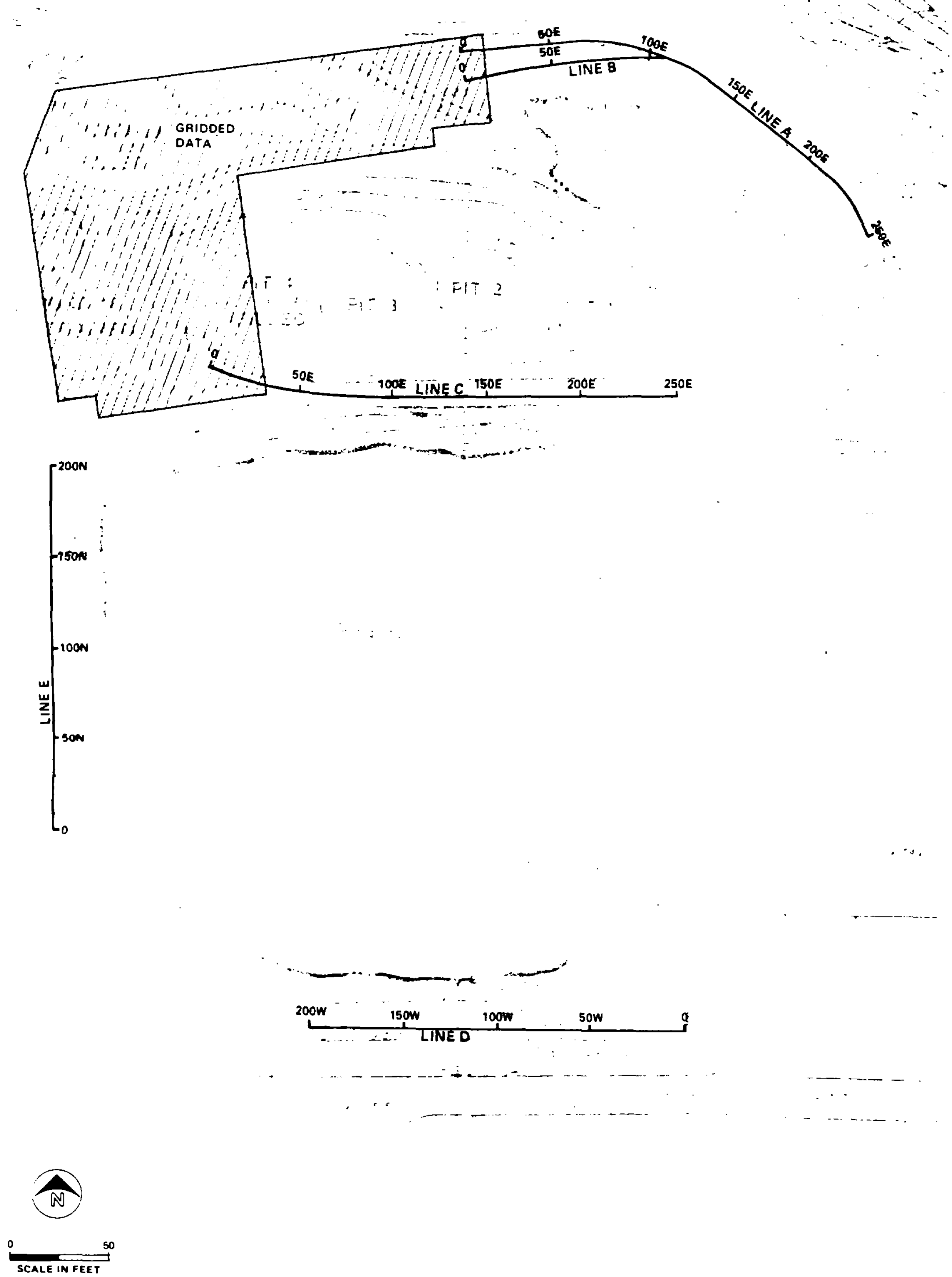
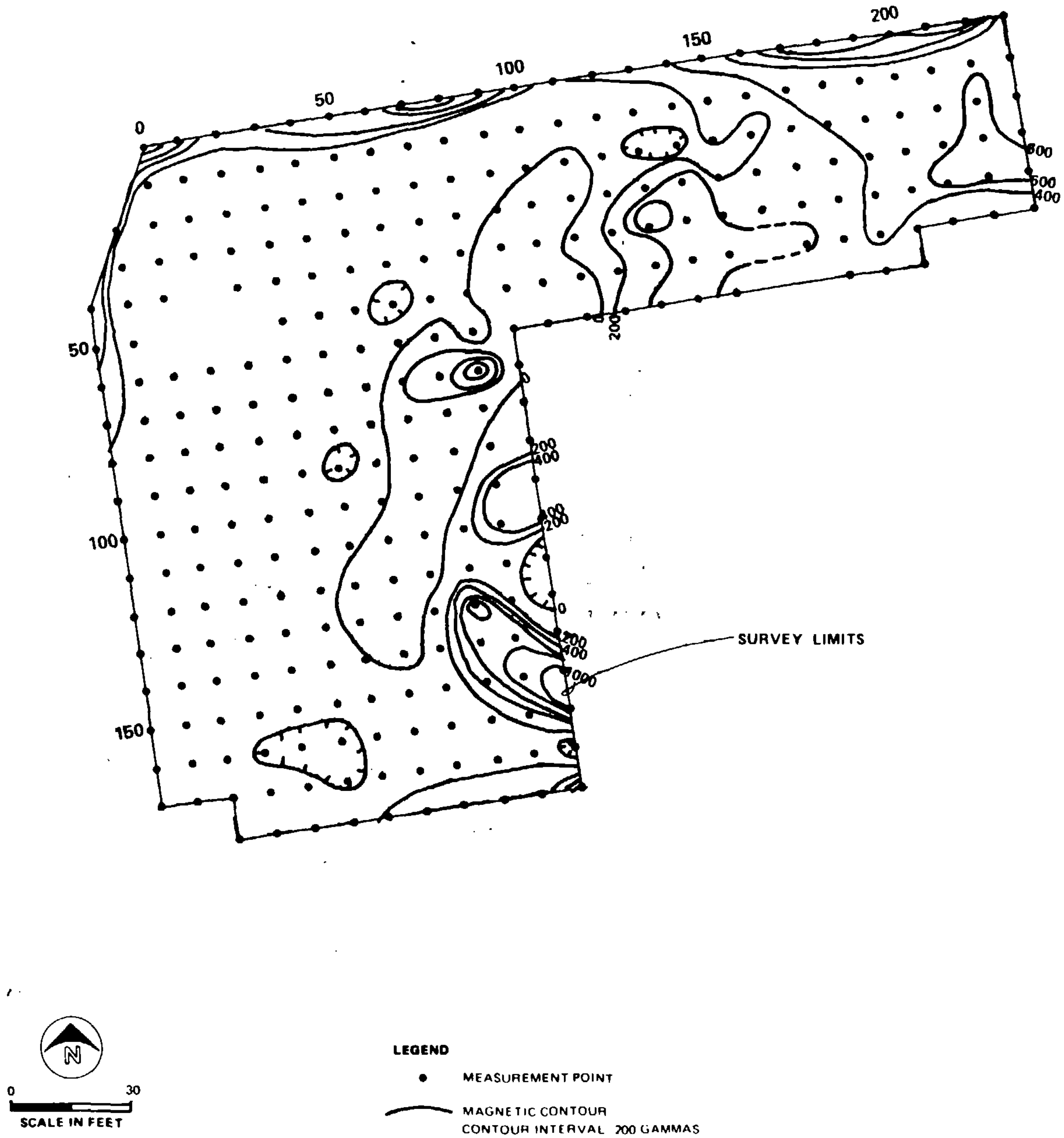


FIGURE B-1-9
MAGNETOMETER SURVEY LOCATION
NOVEMBER 1987



LEGEND

• MEASUREMENT POINT

MAGNETIC CONTOUR
CONTOUR INTERVAL 200 GAMMAS
DATUM 56,400 GAMMAS

FIGURE B-1-10
MAGNETIC INTENSITY MAP
LASKIN POPLAR

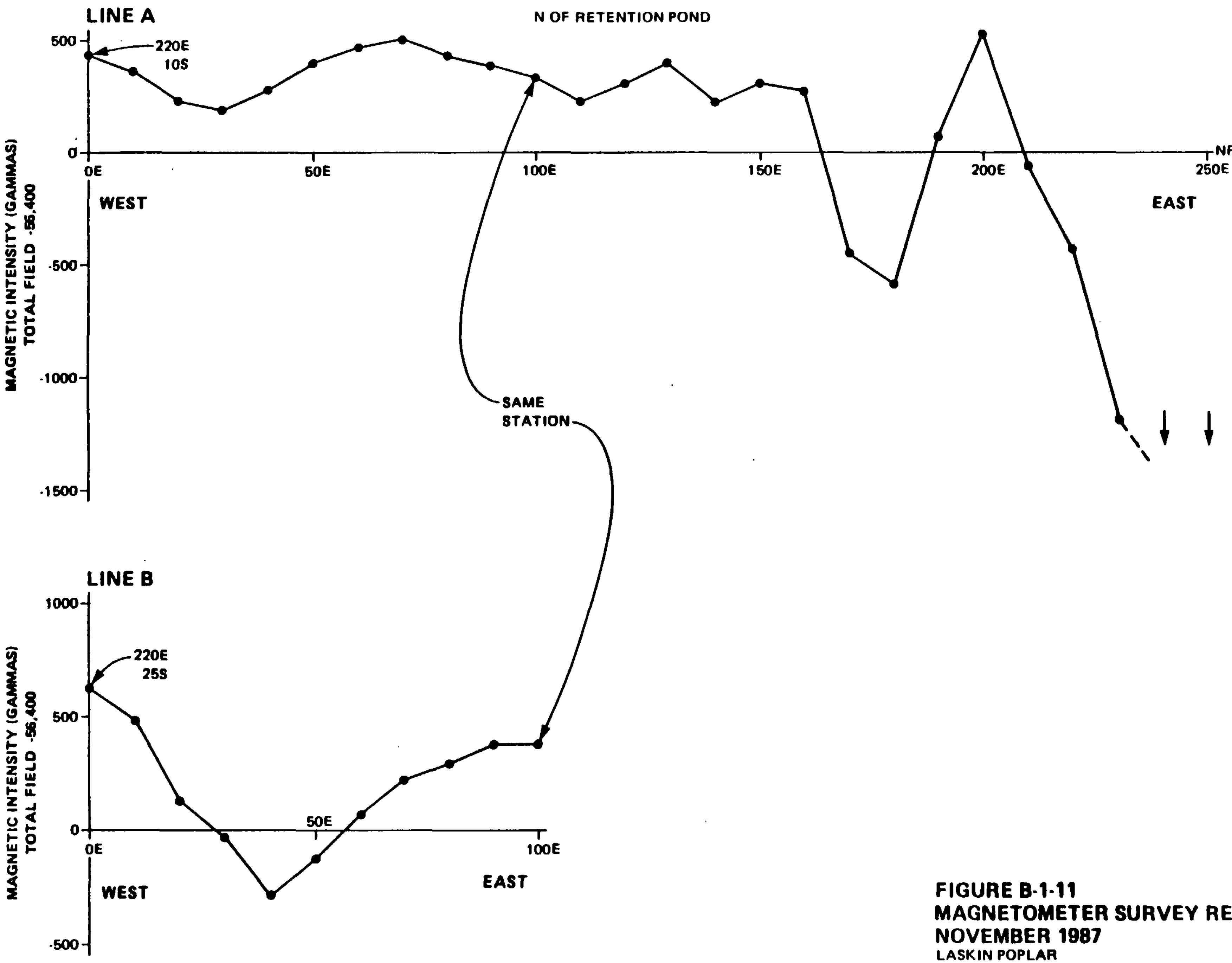


FIGURE B-1-11
MAGNETOMETER SURVEY RESULTS
NOVEMBER 1987
LASKIN POPLAR

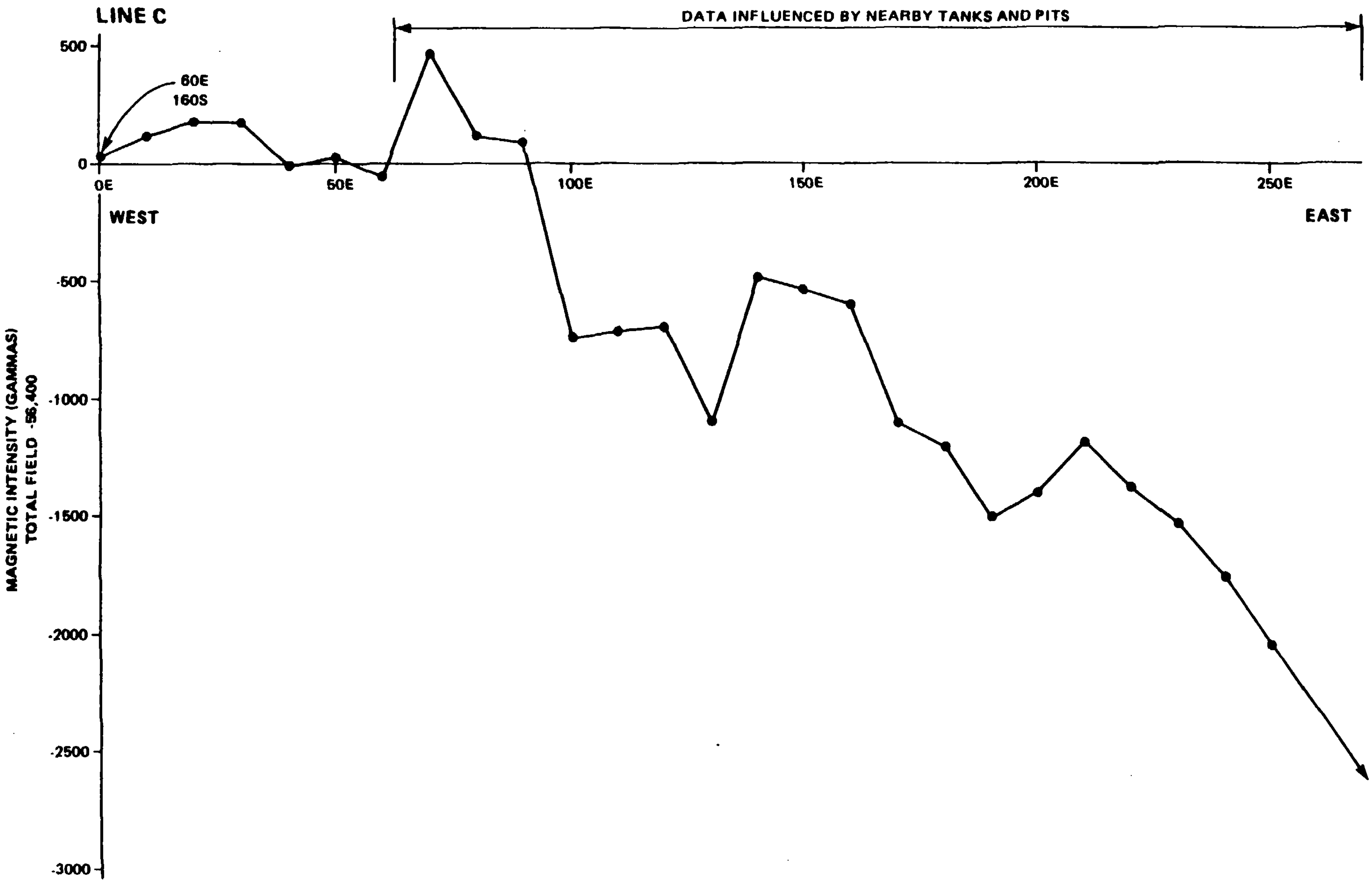


FIGURE B-1-12
MAGNETOMETER SURVEY RESULTS
NOVEMBER 1987
LASKIN POPLAR

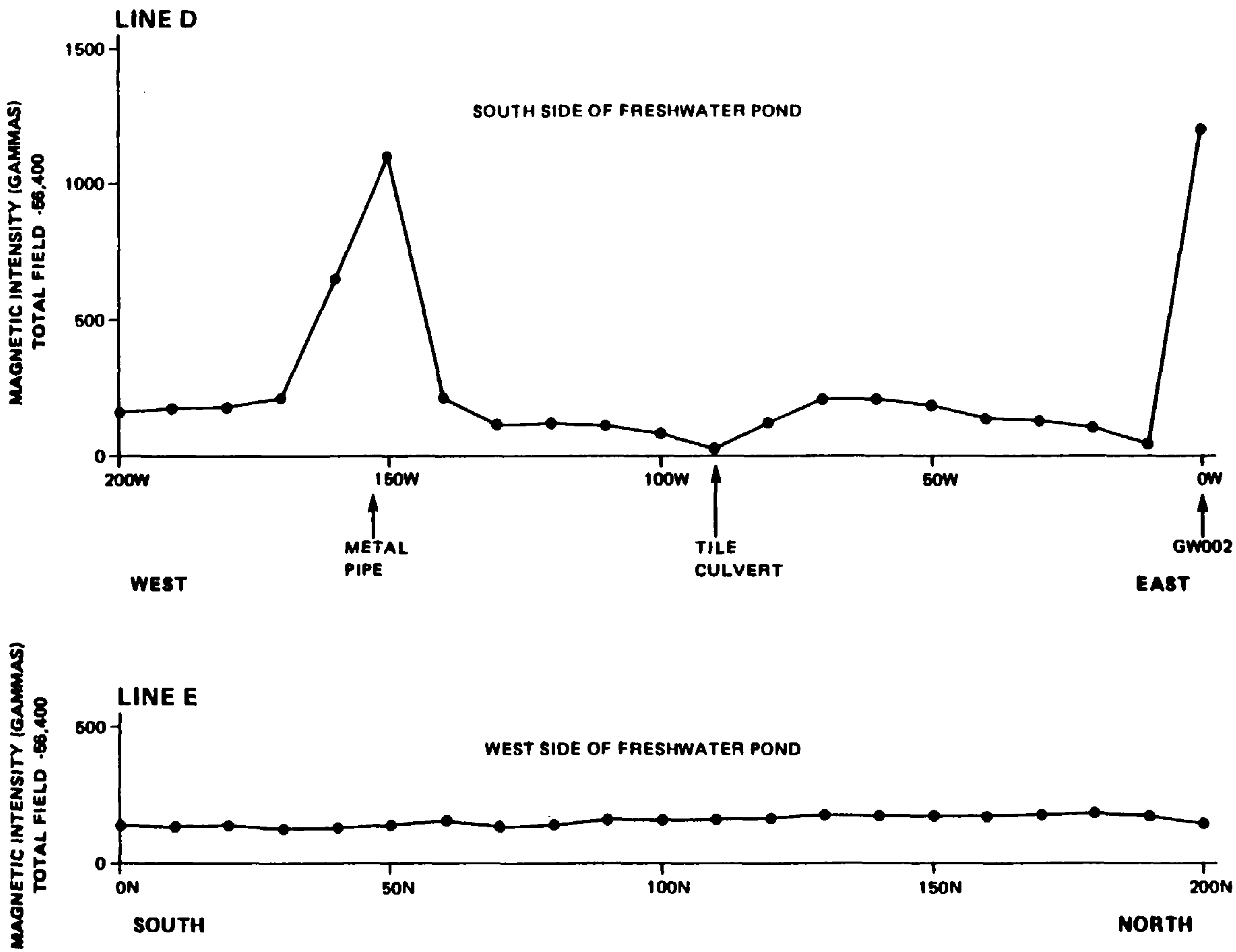


FIGURE B-1-13
MAGNETOMETER SURVEY RESULTS
NOVEMBER 1987
LASKIN POPLAR

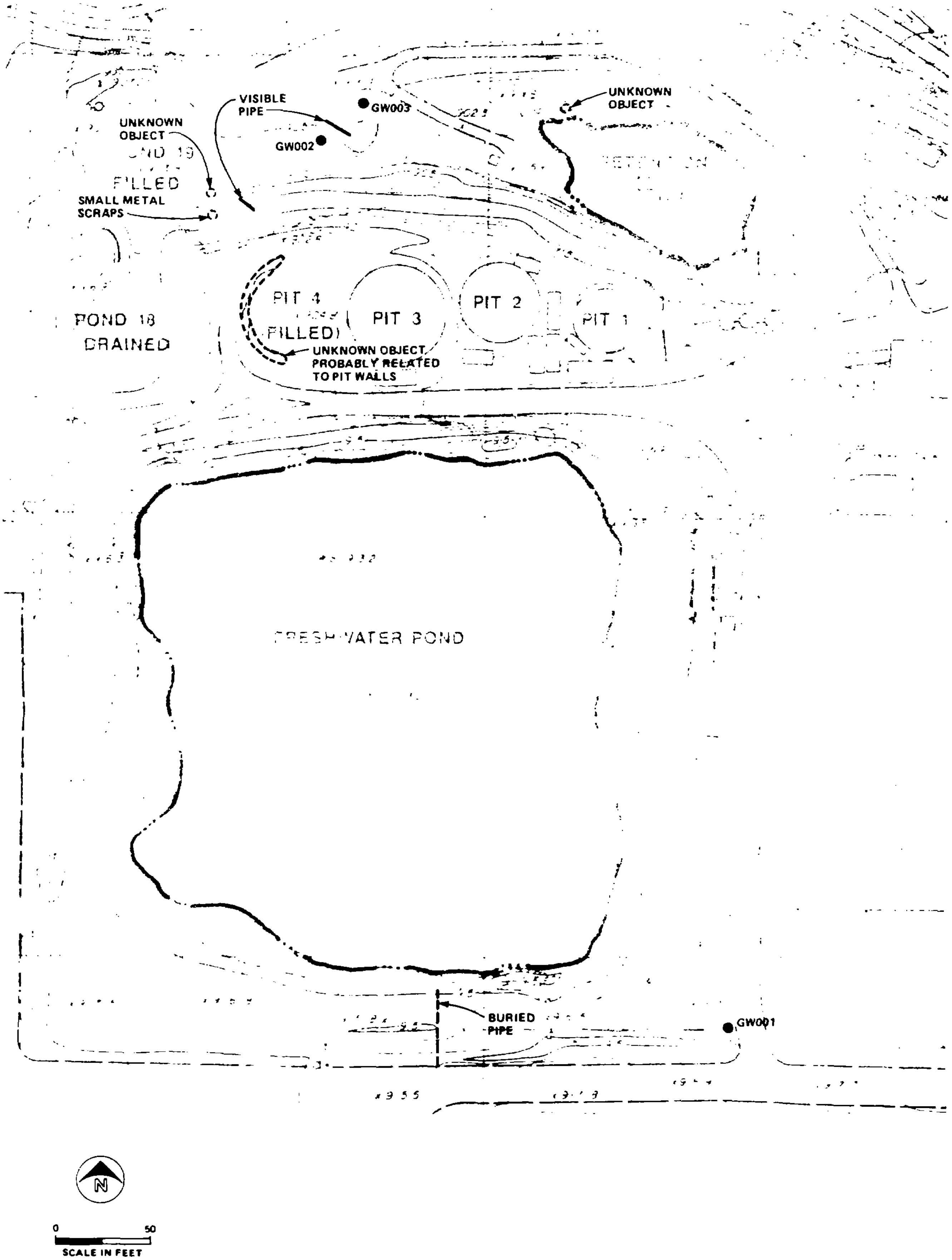


FIGURE B-1-14
MAGNETOMETER SURVEY RESULTS
LOCATION OF METAL
NOVEMBER 1987
LASKIN POPLAR

Fieldwork Memorandum B-2
GEOLOGIC MAPPING

GLT777/48-2

CH2M HILL

FIELDWORK MEMORANDUM B-2

TO: Donna Twickler, U.S. EPA Remedial Project Manager

FROM: Randy Videkovich, CH2M HILL Site Manager

PREPARED BY: Roger Huddleston, CH2M HILL

DATE: February 4, 1988

RE: Phase II RI Geologic Mapping
Laskin Poplar Oil Site
EPA WA 132-5N03

PROJECT: W68792.FP

INTRODUCTION

Data for geologic mapping were collected at the Laskin Poplar site on November 23, 1987, by Roger Huddleston/CH2M HILL and Glen Anderson/Engineer's International, Inc. Bedrock outcrops were mapped, and the strike and dip of the bedding were measured with a Brunton compass where possible. Mapping was performed to identify areas of exposed bedrock in the valley sides and the streambed. The information obtained will be used with the soil boring information to characterize the site geology. Mapping was also performed to identify the extent of fracturing and weathering at the bedrock surface and to determine bedding and fracture orientation, if possible.

RESULTS

Bedrock was generally a gray, weathered, fractured shale with layers of more resistant siltstone or shaly-limestone in places. The resistant layers were approximately 8 inches thick, and were found on the north bank on Cemetery Creek. One is found at an elevation approximately 5 feet above the creek level, and another at an elevation 20 feet above the creek level.

Strikes and dips of the bedrock surface were difficult to obtain. The weathered nature of the rock on the slope caused the slopes to fail easily, not leaving many three-dimensional rock surfaces to measure. The nearly level nature of the bedrock made accurate measurement of strike and dip difficult.

Along the north side of Cemetery Creek, strikes and dips could only be obtained on the resistant layers, which strike generally east-west and dip very slightly to the north (Figure B-2-1). Along the south side of the creek, the only rock outcrops found were in the ravine on the site's west end. The shale there was found to strike approximately northeast-southwest and dip very gently to the northwest.

Most fractures in the bedrock appeared to be parallel to the bedding, although vertical fractures were also noted. However, fractures not parallel to bedding could not be measured accurately because a three-dimensional surface for measuring true strike and dip of the fracture surface was not present. It was difficult to determine whether vertical fractures on rock outcrops were the product of surficial weathering or true rock fractures. However, vertical fractures less than 2 inches were noted in small seams of rock in samples collected during well drilling.

GLT777/3

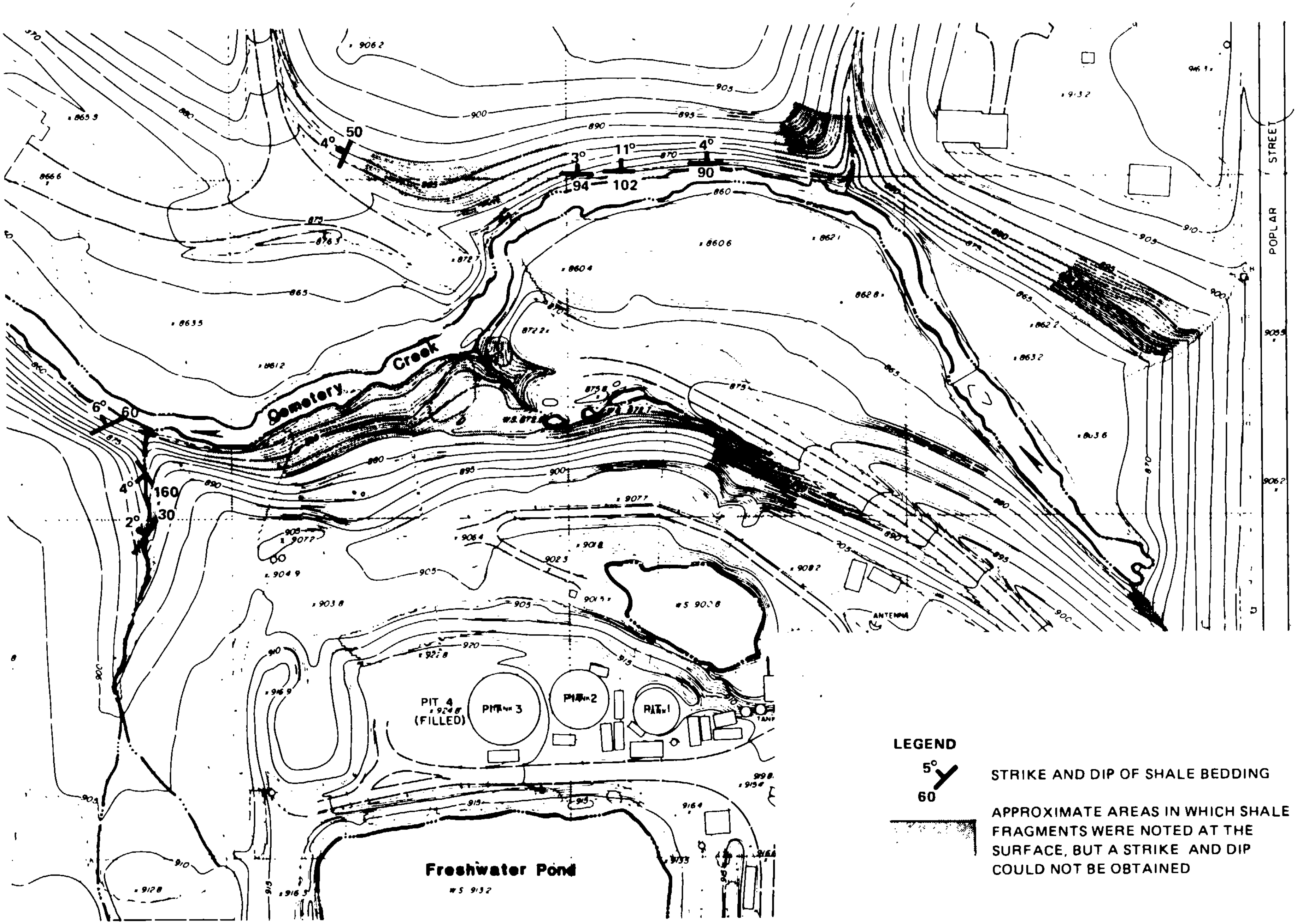


FIGURE B-2-1
BEDROCK OUTCROPS
LASKIN POPLAR OIL

Fieldwork Memorandum B-3
EXISTING WELL EVALUATION

Bailers were decontaminated with a trisodium phosphate wash, water rinse, methanol rinse, and distilled water rinse between wells. The nylon rope was disposed of and replaced with a clean piece of rope between wells. After the wells were purged, water level recovery was measured at regular intervals with a water level indicator.

The well evaluation team was made up of:

- o Roger Huddleston, CH2M HILL, SSO/Level D
- o Bob Weinschrott, CH2M HILL, SSO/Level D
- o Glen Anderson, Engineers International, Inc.
- o Scott Brockway, Engineers International, Inc.

SITE SAFETY CONCERNS

The well evaluation was performed in Level D protection. OVA readings were at background in the breathing zone at all wells except GW008 and GW009. During bailing of GW009, OVA readings pulsed above 1 ppm but dissipated quickly. However, during bailing of GW008, emissions exceeded 30 ppm in the breathing zone and the downhole OVA reading ranged from 150 to 900 ppm. Work ceased immediately at this hole. Further work at GW008 will be in Level C or Level B protection.

RESULTS

VISUAL INSPECTION AND COMPARISON OF CONSTRUCTION

Wells B-1 through B-3 (1981 U.S. EPA) consisted of a 2-inch steel standpipe without a protective casing, lock, or concrete pad. Observed well construction materials were consistent with recorded well construction materials. The wells were intact in the ground.

Phase I RI wells (GW001 through GW005) were constructed with a 2-inch PVC riser and a 4-inch steel protective casing with locking cap set in a cement pad. Observed well construction materials were consistent with recorded well construction materials. The wells were intact in the ground, although the concrete pads were broken.

Wells GW006 through GW011 (1986 TES) were constructed with a 2-inch stainless steel riser and a 4-inch steel protective casing with a locking cap set in a concrete pad. Observed well construction materials were consistent with recorded

CH2M HILL

FIELDWORK MEMORANDUM B-3

TO: Donna Twickler, U.S. EPA Remedial Project Manager

FROM: Randy Videkovich, CH2M HILL Site Manager

PREPARED BY: Roger Huddleston, CH2M HILL Team Member

DATE: February 4, 1988

RE: Phase II RI Existing Well Evaluation
Laskin Poplar Oil Site
EPA WA132-5N03

PROJECT: W68792.FI

INTRODUCTION

Between November 20 and 22, 1987, CH2M HILL conducted evaluations of the existing wells at the Laskin Poplar site in Jefferson, Ohio. Fourteen existing wells (Figure B-3-1) were evaluated to determine their suitability for subsequent RI investigations. Well evaluations consisted of:

- Visual inspection of wells for obvious damage.
- Comparison of actual well construction to installation logs for dimensions of construction.
- Drawdown-recovery tests to determine if the well screens were clean of silt and hydraulically connected to the aquifer.
- Redevelopment of selected wells.

METHODOLOGY

Static water levels were measured in all 14 wells. Well construction details of casing stickup, riser depth below protective casing, and well depth were measured. The water level indicator was decontaminated with a trisodium phosphate wash and a water rinse between each well. Wells were either purged of a minimum of three standing water volumes or bailed dry where well recoveries were slow. Purge water was contained onsite in 55-gallon drums. Stainless steel bailers and nylon rope were used to purge wells constructed of stainless steel. A PVC bailer and nylon rope were used to purge wells constructed of galvanized steel or PVC.

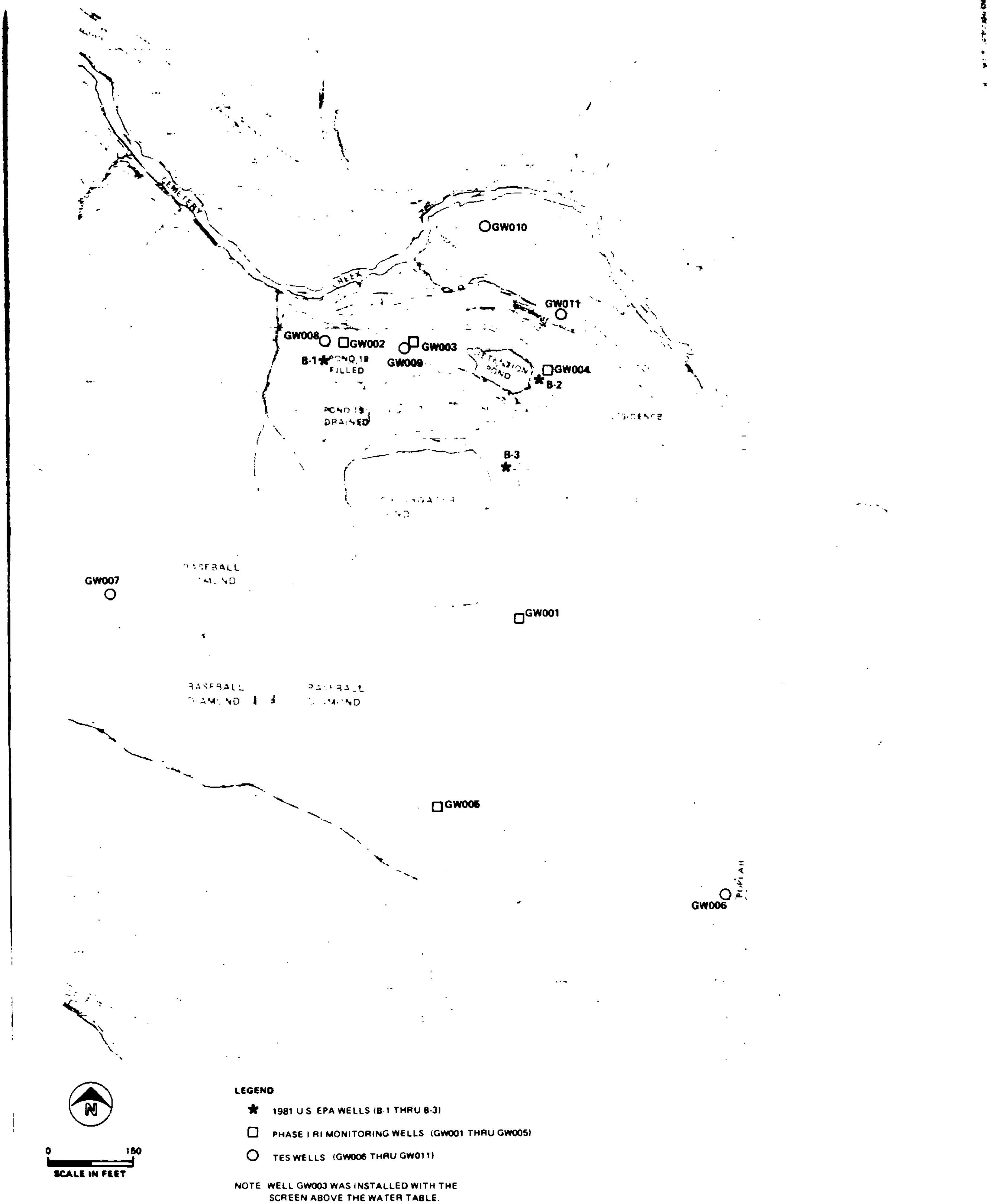


FIGURE B-3-1
EXISTING MONITORING WELL LOCATIONS
LASKIN POPLAR OIL

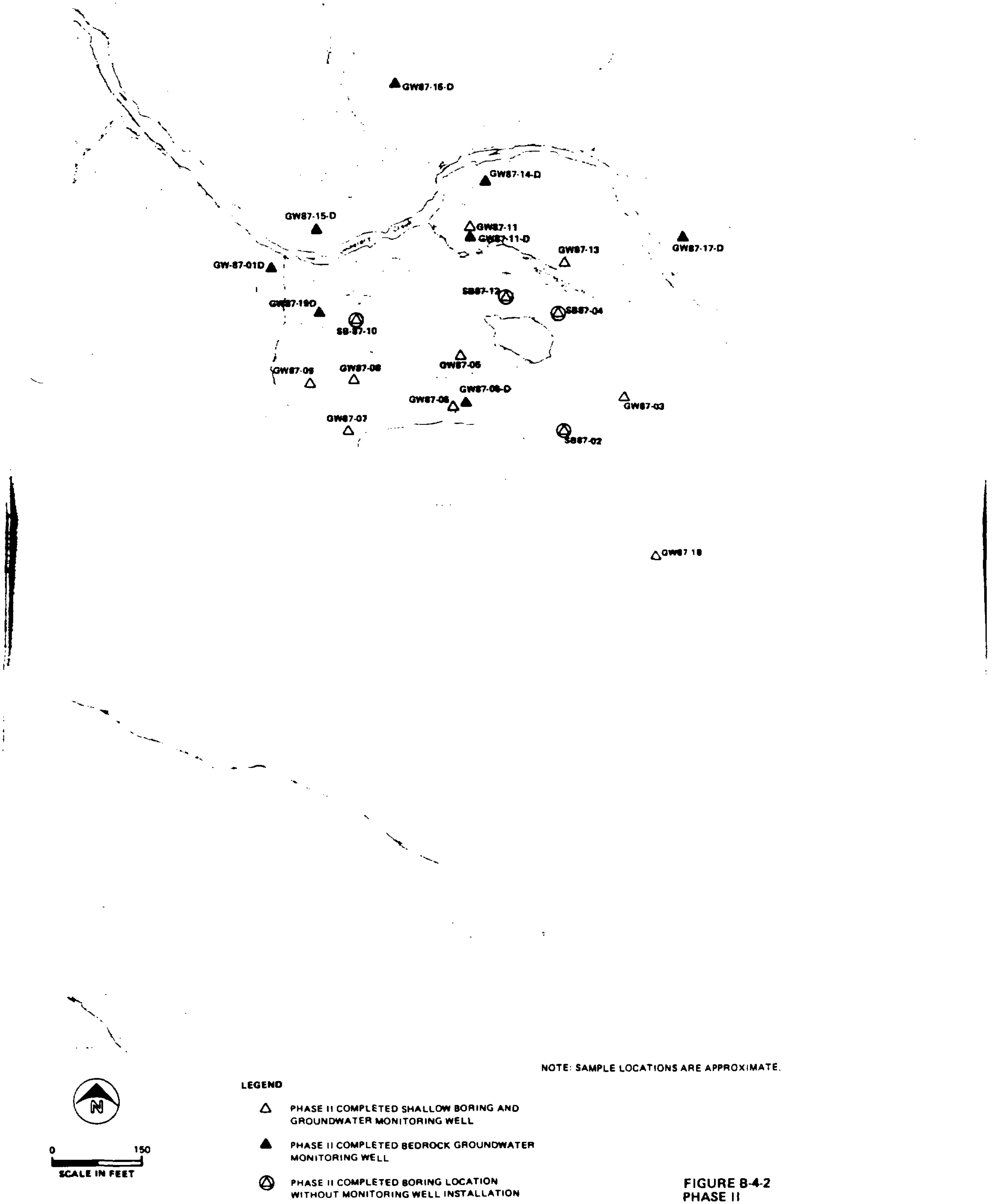


FIGURE B-4-2
PHASE II
RI GROUNDWATER MONITORING
WELL AND SOIL BORING LOCATIONS
LASKIN POPLAR

Table B-4-3
HEALTH AND SAFETY PROTECTION SUMMARY

Well Number	Highest Level of Protection Required: During Drilling	During Development
GW87-01-D	Level D	Level D
GW87-03	Level D	Level D
GW87-05	Level B	Level B
GW87-06	Level D	Level C
GW87-06-D	Level D	Level D
GW87-07	Level D	Level D
GW87-08	Level B	Level B
GW87-09	Level D	Level D
GW87-11	Level C	Level D
GW87-11-D	Level D	Level D
GW87-13	Level D	Level D
GW87-14-D	Level D	Level D
GW87-15-D	Level D	Level C
GW87-16-D	Level D	Level D
GW87-17-D	Level D	Level D
GW87-18	Level D	Level D
GW87-19-D	Level D	Level D
SB87-02	Level D	--
SB87-04	Level C	--
SB87-10	Level B	--
SB87-12	Level B	--
GW009	--	Level C

-- Not applicable

GLT777/66

Appendix B-4
ATTACHMENT 1
BORING LOGS

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
W68792.FI	GW-87-01D	SHEET 1 OF 2

SOIL BORING LOG

PROJECT Laskin Poplar LOCATION West of Ravine
ELEVATION 899.46' DRILLING CONTRACTOR ETI
DRILLING METHOD AND EQUIPMENT CME 750 Rotary wash with 2 15/16" b.t, reamed with 4 7/8" b.t
WATER LEVEL AND DATE START 1/10/88 FINISH 1/12/88 LOGGER RE Huddleston

DEPTH BELOW SURFACE (FT)	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY (FT)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: NAME, GRADATION OR PLASTICITY, PARTICLE SIZE DISTRIBUTION, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
5	4.5-6.5	SS-1	2'	8-17-17-19 (34)	Light brown clayey SILT (ML-CL) TILL, trace dark brown mottles and yellow-rust stains on soil structure surfaces, blocky structure, with ~20% fine gravel, slightly stiff	
						Driller notes: drilling got harder at ~9'
10	9.5-11.5	SS-2	2'	9-13-17-19 (30)	Gray silt-clayey SILT (ML-CL) TILL, with orange-rust stains on breaks along soil structure surfaces, blocky structure, with 20-30% medium angular gravel, all gravel fragments are shale	~12' drilling becomes very hard, slow, smooth driller says drilling appears to go through 6" of very hard material, followed by 6" of soft material. Change bit at 13' drilling proceeds somewhat faster
15	14.5-[illegible]	SS-3	6"	100/.45'	Gray SHALE, weathered to orange-rust on fractures parallel to bedding, friable, breaks easily in parallel beds ~2mm in thickness	
20	19.5-21.5	SS-4	6"	100/6"	As above	Drill chatter at ~22' Slow drilling 22-22.5' changes to softer, easier drilling
25	24.5-26.5	SS-5	3"	100/.2'	As above, staining no longer noted along fracture surfaces	
30						

CH2M HILL

PROJECT NUMBER	BORING NUMBER
	6W-87-01 D SHEET 2 OF 2

SOIL BORING LOG

PROJECT ______ LOCATION ______

ELEVATION ______ DRILLING CONTRACTOR ______

DRILLING METHOD AND EQUIPMENT ______

WATER LEVEL AND DATE ______ START ______ FINISH ______ LOGGER ______

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (INCHES)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: NAME, GRADATION OR PLASTICITY, PARTICLE SIZE DISTRIBUTION, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	30-32	SS-6	.2'	100/.2'	As above	Have lost almost no water circulating in hole
35	35-37	SS-7	.2'	100/.2'	As above	Driller notes material is fairly soft 35-39', harder at ~39'
40	40-42	SS-8	.1'	100/.1'	As above	Slower drilling (harder rock) at ~43' Have noted no vertical fractures in this hole
45	45-47	SS-9	.2'	100/.2'	As above	Very hard rock, slow & smooth drilling 45-50'
					Sand Pack	
50	50-52	SS-10	.1'	100/.1'	As above, sample dry	
55	55-57	SS-11	.2'	100/.2'	As above	End of day 1/10 55-57' smooth, easy drilling 57-60' much slower drilling
					As above	
60	60-62	SS-12	.2'	100/.2'	Screened Interval	Boring open to 60.0'

RECOMMENDATIONS

Because B-3 appears to be contaminated with grout or bentonite, it should be abandoned. Wells B-1 and B-2, however, appear to be usable for both water level monitoring and groundwater sampling although they are constructed of steel standpipe and do not meet current standards for monitoring well construction.

GW003 shall be abandoned because it is a dry well. All other PVC wells (GW001 through GW005) appear to be usable for both water level monitoring and groundwater sampling.

Because of their disproportionately slow recovery, GW009 and GW010 should be redeveloped. However, GW010 is so shallow (less than 10 feet deep) that redevelopment may not be effective. It is assumed that GW008 is an acceptable well for both water level monitoring and groundwater sampling on the basis of the appearance of water that was removed, even though the well was neither bailed as completely as other wells nor monitored as the water level recovered. All other stainless steel wells appear to be usable for both water level monitoring and groundwater sampling.

GLT777/6

Fieldwork Memorandum B-4
MONITORING WELL INSTALLATION

FIELDWORK MEMORANDUM B-4

CH2M HILL

TO: Donna Twickler/Remedial Project Manager, U.S. EPA

FROM: Randy Videkovich/Site Manager, CH2M HILL

PREPARED BY: Roger Huddleston/CH2M HILL
Kevin Olson/CH2M HILL

DATE: February 25, 1988

RE: Phase II RI Monitoring Well Installation
Laskin Poplar Oil Site
EPA WA 132-5N03

PROJECT: W68792.FI

INTRODUCTION

Groundwater monitoring wells were installed at Laskin Poplar Oil site between December 1, 1987, and January 26, 1988. Exploration Technology, Inc. (ETI) of Madison, Wisconsin, drilled, constructed, and developed all of the wells.

This memorandum describes the installation and in-ground specifications of the monitoring wells at the Laskin Poplar site. The work described is part of Task FI, Field Work--Monitoring Well Installation.

SCOPE

The intended scope of the new well installation consisted of installing nine shallow groundwater monitoring wells in overburden sediments or weathered shale deposits and installing eight deep groundwater monitoring wells in the unweathered shale bedrock beneath the site. The new wells, in conjunction with the existing monitoring well network, were installed to refine both the understanding of site hydrogeology and the nature and extent of groundwater contamination. These objectives were achieved by collecting groundwater samples for analysis, by collecting groundwater elevation information, and by conducting aquifer tests in the wells.

PERSONNEL

The field team observing the soil boring advancement and monitoring well installation and development consisted of:

Roger Huddleston/CH2M HILL
Bob Weinschrott/CH2M HILL
Kevin Olson/CH2M HILL
Angelo Liberatore/CH2M HILL
Scott Brockway/Engineers International, Inc.
Glen Anderson/Engineers International, Inc.

Roger Huddleston and Robert Weinschrott acted as site safety officer for each drill rig. Not all members of the field team were onsite for the duration of the drilling. They were brought onsite as necessary when sampling activities or Level B work required additional personnel.

FIELD CHANGES TO FINAL WORK PLAN

Initially, existing well GW010 was to be sampled before the installation of wells north of Cemetery Creek. The decision to install wells north of Cemetery Creek was to be based partly on the analytical results from GW010. However, the Contract Laboratory Program could not provide the turnaround time necessary to evaluate the data before making the decision to install wells north of Cemetery Creek. To allow fieldwork to proceed in a timely manner, it was decided not to sample GW010 before the new wells were installed.

Shallow wells GW87-15 and GW87-17 were originally planned to be overburden wells nested with deep rock wells to assess vertical groundwater gradients and extent of contamination. However, the overburden materials were too thin (less than 5 feet) to install shallow wells, so the shallow wells were eliminated. The shallow well originally planned to be nested with GW87-16-D was eliminated because the preliminary hydrogeological interpretation performed during the Phase II RI fieldwork indicated that the surficial aquifer north of Cemetery Creek was not hydraulically connected to the surficial aquifer south of Cemetery Creek. Thus, the well would not yield useful information in determing the nature and extent of contamination.

GW87-01 was originally planned to be upgradient of the freshwater pond for assessing upgradient groundwater quality because it was assumed that GW001 would be unusable for that purpose. However, during the existing well evaluation, it was determined that GW001 was usable for groundwater sampling, so an additional well in that location was not needed.

GW87-01 was relocated to a point west of the ravine on the west end of the site. During the existing well evaluation, organic vapor emissions (as measured with an OVA) exceeded 500 ppm in GW008, a shallow monitoring well on the east side of the ravine, suggesting high organic groundwater contamination. A deep well (GW87-19-D) was installed near GW008 to assess the degree of contamination in the bedrock east of the ravine. The GW87-01 location was chosen to further define the nature and extent of groundwater contamination in the bedrock west of the ravine. Because the ravine cuts across the shallow aquifer in that area, it was determined that a shallow well west of the ravine was unnecessary. However, extent of contamination in the bedrock beneath the ravine was unknown. As a result, GW87-01 was installed as a deep well and designated GW87-01-D.

Upon auger refusal, bedrock was to be cored using an HQ or NX core barrel. Coring was attempted in GW87-15D, the first deep well drilled. However, because the shale is soft, the rock did not core well and recovery during coring was very poor. The decision was made to change from the more expensive and time-consuming rock coring to the less expensive and efficient roller bit drilling method with split-spoon sampling at 5-foot intervals. Deep borings would be advanced with a tricone roller bit until the nature of the drilling indicated that rock was hard enough to core. However, the nature of bit advancement was such that the rock appeared to be alternating layers of more resistant shale (good for coring) with softer, less resistant layers of shale (very poor for coring). As a result, none of the remaining deep wells were cored, although split-spoon samples were collected to assess the hardness and fracturing of the rock.

FIELD METHODS

DRILLING

Boreholes were drilled using hollow-stem augers, rotary wash, or a combination of both methods. Shallow boreholes were generally drilled using 4-1/4-inch I.D. hollow-stem augers. Borings for shallow wells were drilled to a depth at which the well screen would straddle the water table, having approximately 3 feet of screen above the water table and 7 feet of screen below.

Deep boreholes that penetrate the unweathered shale were usually below the depth of auger refusal. They were drilled by rotary wash using a 2-15/16-inch roller bit followed by reaming with either a 3-7/8-inch or 4-7/8-inch bit. Specific information regarding the drilling method for each borehole is provided on the soil boring logs (Attachment 1).

ETI supplied two rigs to perform the work: one CME 55 (truck mounted) and one CME 750 (ATV).

Drilling rigs, augers, tools and other equipment coming in contact with the borehole or cuttings were decontaminated by steam cleaning prior to drilling each borehole.

SELECTION OF SCREENED ELEVATION FOR DEEP WELLS

Depth of the deep borings was estimated so that the well screens of all the deep wells would be set in the same bedrock bedding plane assuming a 3° north dip of the bedrock. An average dip of 3° north was assumed because geologic mapping indicated the average representative bedrock dip was between 3° and 4° north.

Ground surface elevations at the proposed deep well locations were estimated from the topographic map. However, some well locations were adjusted slightly in the field, resulting in a different ground surface elevation at the well than that originally used to calculate the appropriate well depth. The amount of error was not known until after all the wells had been completed and surveyed. In addition, the flat nature of the bedrock and the coinciding difficulty in measuring true strike and dip, combined with the highly interlayered nature of hard and soft zones separating the aquifers, may have resulted in some wells not being screened in the same bedding plane.

Analysis of screened elevation data (Table B-4-1) and assumed bedrock dip indicated that that was the case. Wells GW87-06D, GW87-14D, GW87-15D, and GW87-17D appear to be screened in the same plane, based on their screened interval elevations. Wells GW87-01D, GW87-11D, GW87-16D, and GW87-19D are approximately 3 to 5 feet lower than they should be. Thus, if the groundwater flow along this bedding is in the upper 3 to 5 feet of the bedding plane, water elevations in these wells will not reflect the same elevations as those obtained in wells GW87-14D, GW87-15D, GW87-17D, and

GW87-06D. These discrepancies must be due to errors in estimating ground surface elevations, since the assumed dip is the same and the interlayered nature of the bedrock was not known before the commencement of drilling. Because of the highly interlayered nature of the bedrock and the likelihood that the bedrock dip is not consistently 3° across the site, it is probable that even those wells screened at the proper elevations as originally estimated are not screened in the same bedding plane.

WELL CONSTRUCTION

Following completion of the borehole, the auger flights or drill string was removed from the hole. New, steam-cleaned stainless steel well screen and riser pipe were assembled, measured, and inserted in the borehole. The casing string was centered in the borehole by visual observation.

Number 30 sand (approximately 1/2-mm diameter) was poured directly from factory packed bags into the borehole to the desired depth of the sand pack. The elevation of the sand pack was sounded at frequent intervals for comparison to the expected elevation based on the volume of sand added to the hole.

Bentonite pellets were placed above the sand to a thickness of about 2 feet by dropping them down the open borehole. If the water level following the addition of the sand was below the top of the sand, then clear water was added with the bentonite to activate the pellets.

Above the bentonite pellets, a cement/bentonite slurry was mixed and tremied into the borehole. The slurry generally came to within 2 to 3 feet of the ground surface.

Protective casing was then placed in the borehole. The casing was supported by the cap on the well casing, which was unscrewed as much as possible. This arrangement allowed installation of the surface seal prior to substantial setup of the grout (which could take several days). The well casing cap was partially unscrewed so that a space would exist between the protective casing and well casing following setup of the surface seal, which normally supports the protective casing.

20-Jul-88

Table B-4-1
SURVEYED WELL ELEVATIONS AND WELL DIMENSIONS

WELL NUMBER	TOP OF RISER ELEVATION	TOP OF CASING	GROUND SURFACE	TOP OF SCREEN BGS	TOP OF SCREEN ELEV.	BOTTOM OF SCREEN BGS	BOTTOM OF SCREEN ELEV.
CW001	919.91	919.98	917.82	22.5	895.3	27.5	890.3
CW002	904.94	905.02	903.91	19.0	884.9	24.0	879.9
CW003 (a)	907.30	907.37	905.2	17.5	887.7	22.5	882.7
CW004	909.70	909.82	908.12	18.5	889.6	23.5	884.6
CW005	917.60	917.85	915.60	23.0	892.6	28.0	887.6
CW006	921.70	922.02	918.65	11.0	907.7	16.0	902.7
CW007	913.87	914.16	912.32	28.5	883.8	33.5	878.8
CW008	907.54	907.82	904.44	19.5	884.9	24.5	879.9
CW009	907.65	907.91	905.16	22.0	883.2	27.0	878.2
CW010	863.82	864.12	861.04	5.0	856.0	7.0	854.0
CW011	891.59	892.18	889.99	23.5	866.5	28.5	861.5
CW87-01-D	902.00	902.31	899.46	49.3	850.2	60.0	839.5
CW87-03	914.76	914.98	911.94	13.4	898.5	24.1	887.8
CW87-05	922.97	923.19	919.38	31.1	888.3	41.8	877.6
CW87-06	922.36	922.56	920.29	25.2	895.1	35.9	884.4
CW87-06-D	922.89	923.17	919.97	64.5	865.5	65.2	854.8
CW87-07	920.48	920.71	918.07	22.3	895.8	33.0	885.1
CW87-08	910.50	910.76	907.26	8.7	898.6	19.4	887.9
CW87-09	909.09	909.32	907.51	13.0	894.5	23.7	883.8
CW87-11	876.25	876.44	872.54	5.4	867.1	16.1	856.4
CW87-11-D	875.68	875.85	872.82	24.2	848.6	34.9	837.9
CW87-13	883.43	883.64	880.66	9.1	871.6	14.6	866.1
CW87-14-D	863.30	863.71	860.95	14.3	846.7	25.0	835.9
CW87-15-D	862.79	862.96	859.89	14.0	845.9	24.7	835.2
CW87-16-D	908.82	909.04	906.64	74.8	831.8	85.5	821.1
CW87-17-D	865.42	865.71	862.36	14.3	848.1	25.0	837.4
CW87-18	920.08	920.53	918.65	9.4	909.3	20.1	898.6
CW87-19-D	904.09	904.42	901.71	49.5	852.2	60.2	841.5
B1	909.32	N/A	906.36				
B2	909.63	N/A	908.26				
B3	920.83	N/A	916.87				
SB87-02 (b)			915				
SB87-04 (b)			908				
SB87-10 (b)			904				
SB87-12 (b)			907				

STAFF GAUGE	ELEVATION (c)
Freshwater Pond	909.92
Retention Pond	898.37
Cemetery Creek East	858.70
Cemetery Creek West	855.35

NOTES:

(a) CW003 surveyed in Phase I to nearest 0.1 ft.
(b) SB - soil boring elevations are estimated.
(c) Staff gauge reference is the 0.0 mark on each staff gauge.

[File: WELLEL.WK1]

Well completion consisted of mixing and setting the surface seal, installing protective guard posts (if necessary), and locking the protective casing.

A typical well diagram is shown in Figure B-4-1. Detailed information for each well is given on the individual well construction diagrams (see Attachment 2).

WELL DEVELOPMENT

All newly installed wells were developed using bailing methods. Each well was bailed with a stainless steel bailer to remove sediment from the screen and sand pack, and to allow the sand pack to settle. Wells were generally purged of at least nine standing water volumes (as measured from the natural static water level). Development proceeded until sediment content in the water had decreased to a point that additional development would result in only minimal change in the sediment content of the well water. Table B-4-2 is a summary of time spent developing each well and gallons purged from each well.

WELL LOCATIONS

Following well completion, wells were located and plotted on a map using known reference points and surveyed elevations. Well locations are shown in Figure B-4-2.

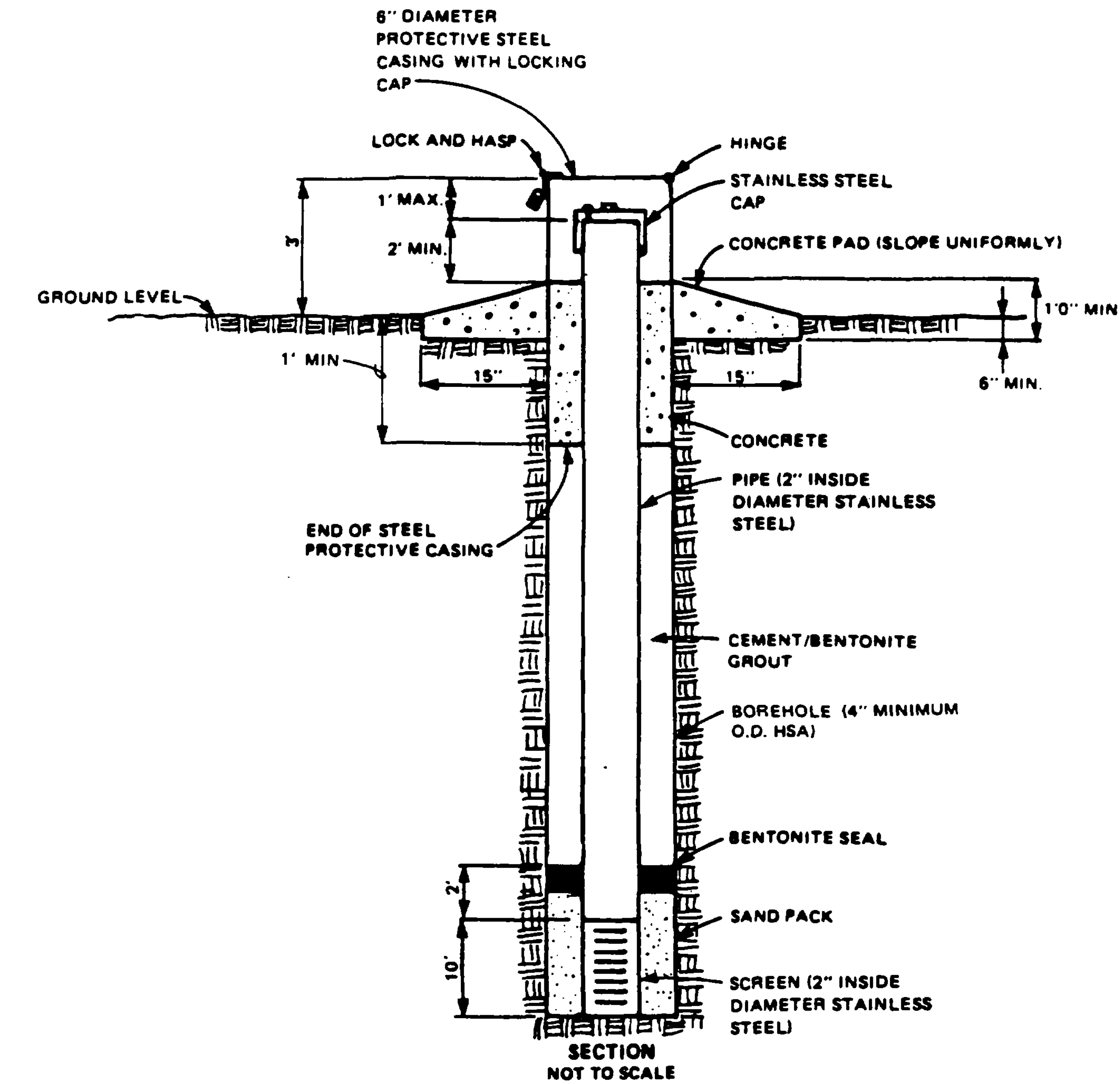
WELL ELEVATIONS

Newly installed and existing wells were surveyed by Robert Weinschrott and Scott Brockway between February 6 and 7, 1988. Elevations of the top of the stainless steel riser were measured to the nearest 0.01-foot using a Leitz Level. Height of the protective casing above both the riser pipe and the ground surface were also measured, and corresponding elevations were calculated. Surveyed vertical elevation data are summarized in Table B-4-1.

HEALTH AND SAFETY PROCEDURES

MONITORING AND LEVELS OF PROTECTION

Volatile organic compound emissions were monitored during soil and water disturbing activities with an Organic Vapor Analyzer (OVA). Oxygen content and lower explosive limit



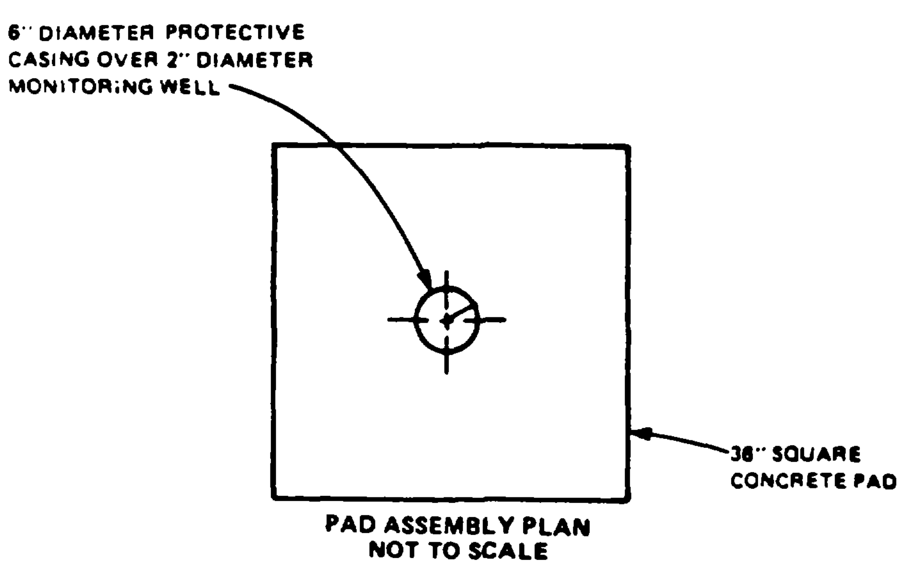


FIGURE B-4-1
TYPICAL MONITORING WELL CONSTRUCTION
LASKIN POPLAR

were monitored when drilling in areas where the potential for explosion existed.

Most borings were completed under Level D health and safety protection. However, at some locations, concentrations of volatile organic compounds in the ambient air (as measured by the OVA) were high enough to require respiratory protection. These borings were completed under Level C or B health and safety protection. A summary of the highest level of health and safety protection required at each location is presented in Table B-4-3.

PERSONAL AND EQUIPMENT DECONTAMINATION

A decontamination line was established in the contamination reduction zone. The decontamination line consisted of a boot wash (water and trisodium phosphate), boot rinse (water), a glove wash (water and trisodium phosphate), and a glove rinse (water). A barrel lined with plastic garbage bags was provided for disposal of contaminated clothing. All workers were required to decontaminate and dispose of any personal protective clothing worn in the exclusion zone before they left the exclusion zone.

The drill rig and equipment used were steam-cleaned between borings. When enough clean equipment was available, the drill rig was not decontaminated between nested wells. Water generated during decontamination was collected in a sump and transferred into DOT-approved 17H 55-gallon drums.

Table B-4-2
WELL DEVELOPMENT SUMMARY

Well Number	Development Time (hr)	Gallons Removed
GW87-01-D	1.0	13.0
GW87-03	3.25	90.0
GW87-05	2.5	26.5
GW87-06	2.5	60.0
GW87-06-D	1.8	19.5
GW87-07	2.3	41.0
GW87-08	4.0	54.0
GW87-09	2.0	65.0
GW87-11	1.75	13.0
GW87-11-D	2.0	25.0
GW87-13	1.1	7.0
GW87-14-D	1.3	50.0
GW87-15-D	1.75	56.5
GW87-16-D	1.1	14.25
GW87-17-D	1.3	50.0
GW87-18	4.8	60.5
GW87-19-D	1.5	18.0
GW-009	1.0	5.0

GLT777/65

well construction materials. The wells were intact in the ground, although the concrete pads were broken.

Well depths were measured for comparison of previously recorded well depths and to determine whether the wells had accumulated silt. A comparison of measured well depths and well depths recorded on the boring logs is presented in Table B-3-1. In most cases, actual well depths were similar to previously recorded well depths. Actual depths were generally within 0.75 foot of the previously documented well depths, an error that can be accounted for in the imprecision of measurements made during well construction following borehole completion.

Only one well, B-3, had a difference of greater than 0.75 toot. The measured depth of B-3 was 2.56 feet less than the recorded depth. B-3, however, was also the only well that contained silt in the bottom. A gray, grout-like material was also noted in the bottom of B-3 as water was bailed from the well. The material may be cement-bentonite grout or bentonite slurry seal. No other wells were noted to contain an accumulation of silt on the bottom, although water bailed from most wells was slightly turbid.

DRAWDOWN-RECOVERY TESTS

Results of the drawdown-recovery tests were qualitatively assessed to determine whether the well was still hydraulically connected to the aquifer. GW003 is a dry well and therefore unusable. Most wells recovered to approximately 75 percent of the static water level within 1 hour of bailing. Wells GW009 and GW010, however, required approximately 12 hours to fully recover.

Well GW008 was not evaluated because of site safety concerns. Following the removal of one bailer of water from the well, health and safety air monitoring measurements (as indicated by the OVA) indicated that level B health and safety protection would have been required to continue bailing the well. However, since the water did not appear to be excessively turbid and the well did not contain an accumulation of silt on the bottom, the well is assumed to be adequately connected to the aquifer.

Table B-3-1
COMPARISON OF MEASURED WELL DEPTHS TO
WELL DEPTHS LISTED IN BORING LOGS

Well Number	Measured Depth (ft bgs)	Depth on Boring Logs (ft bgs)	Difference Measured
B-1	41.91	42.5	-0.59
B-2	43.93	43.8	0.13
B-3	45.44	48.0	-2.56
GW001	28.13	27.5	0.63
GW002	23.38	24.0	-0.62
GW003	23.00	22.5	0.5
GW004	22.89	23.5	-0.61
GW005	28.74	28.0	0.74
GW006	16.44	16.0	0.44
GW007	33.97	33.5	0.47
GW008	26.45	26.5	-0.05
GW009	26.96	27.0	-0.04
GW010	6.61	7.0	-0.39
GW011	29.18	28.5	0.68

bgs = below ground surface

GLT777/7

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
W68792.FI	GW-87-05	SHEET 1 OF 3

SOIL BORING LOG

PROJECT Laskin Poplar LOCATION Between Pit 3 + Pit 4

ELEVATION 919.38 DRILLING CONTRACTOR ETI

DRILLING METHOD AND EQUIPMENT CME 750 4¼" HSA w/3" Split-Spoon Sampling

WATER LEVEL AND DATE START 12/9/87 FINISH 12/10/87 LOGGER R. Huddleston

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION NAME, GRADATION OR PLASTICITY, PARTICLE SIZE DISTRIBUTION, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	0-2	grab			Light brown Silt, FILL. Black oily sludge crust on surface	
2	2-4	SB87-05-01	2'	2-4-4-4 (8)	Moist brown Silty Clay FILL (CL), with fine angular gravel	
4	4-6	SB87-05-01	1'	1-3-2-2 (5)	As above, higher gravel content, black oily seam noted at 4'	
6	6-8	SB87-05-02	1.5'	2-3-4-4 (7)	As above	
8	8-10	SB87-05-02	2'	1-3-4-8 (7)	As above	
10	10-12	SB87-05-03	2'	3-3-4-7 (7)	As above	
12	12-14	SB87-05-03	2'	4-6-8-11 (14)	As above, black oily layer noted at 13'	
14						

PROJECT NUMBER	BORING NUMBER GW-87-05 SHEET 2 OF 3

SOIL BORING LOG

PROJECT ______ LOCATION ______

ELEVATION ______ DRILLING CONTRACTOR ______

DRILLING METHOD AND EQUIPMENT ______

WATER LEVEL AND DATE ______ START ______ FINISH ______ LOGGER ______

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY ~~(INCHES)~~ FT	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION NAME, GRADATION OR PLASTICITY, PARTICLE SIZE DISTRIBUTION, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	14-16	SB87-05-04	2'	4-8-10-11 (18)	FILL as above, with shaly chips, brick fragments, and an oily wood chip noted	
16	16-18		2'	4-4-6-7 (10)	As above	
18	18-20	SB87-05-05	2'	14-47-53-18 (100)	As above, black oily stained gravel layer noted at 18-18.5'	
20	20-22		1.5'	14-100/3"	As above, hard brick fragment noted in tip of spoon	
22	22-24	SS-11	0.2'	7-8-8-9 (16)	As above	
24	24-26	SB87-05-06	1.8'	22-20-13-23 (33)	As above	
26	26-28		1.8'	4-6-9-26 (15)	as above	
28						

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
W68792.FI	GW-87-03	SHEET 1 OF 2

SOIL BORING LOG

PROJECT Laskin Poplar LOCATION Laskin's Driveway

ELEVATION 911.94 DRILLING CONTRACTOR ETI

DRILLING METHOD AND EQUIPMENT CME 55 4¼" HSA with 3" Split-Spoon Sampling

WATER LEVEL AND DATE ______ START 12/16/87 FINISH 12/16/87 LOGGER G. Anderson

DEPTH BELOW SURFACE (FT)	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY (INCHES)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: NAME, GRADATION OR PLASTICITY, PARTICLE SIZE DISTRIBUTION, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	0-2	grab			Brown-black SAND and GRAVEL with coal/cinder fragments	
	2-4	SB87-03-01 for chemical analysis	20"	13-28-34-41 (62)	Brown-Gray silty CLAY (CL), trace sand and gravel, moist, stiff	
5	4-6		18"	20-23-33-29 (56)	As above, with sand and gravel/coal seam at 5-5.5'	
	6-8	SB87-03-02	18"	13-23-41-77 (64)	As above	
	8-10		8"	32-100/5"	Gray Weathered SHALE, with orange-brown iron staining along vertical and horizontal fracture surfaces, easily crumbled between fingers, moist	Driller notes moderately difficult drilling
10	10-12	SB87-03-03	9"	77-100/3"		Sand Pack
					Gray SHALE, fissile, moist	
	12-14		5"	100/5"	As above	Screen
15						

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
	GW-87-03	SHEET 2 OF 2

SOIL BORING LOG

PROJECT ______ LOCATION ______

ELEVATION ______ DRILLING CONTRACTOR ______

DRILLING METHOD AND EQUIPMENT ______

WATER LEVEL AND DATE ______ START ______ FINISH ______ LOGGER ______

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (INCHES)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: NAME, GRADATION OR PLASTICITY, PARTICLE SIZE DISTRIBUTION, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	14-16	SB87-03-04	5"	100/5"	As above	Screened Interval
	16-18	SB87-03-04	5"	100/5"	As above	
	18-20	SB87-03-05	5"	100/5"	As above, fissile layers interbedded with more massive layers, massive layers not easily broken by fingers	
	20-22	SB87-03-05	5"	100/6"	As above, sample appears to be carrying water along horizontal partings	
	22-24	SB87-03-06	5"	100/3"	As above, trace orange-brown iron staining along horizontal surfaces	Driller notes extremely difficult augering
	24-26	SB87-03-06	0"	100/3"	End of Boring at 24.1'	

CH2M HILL

PROJECT NUMBER W68792.FI | BORING NUMBER GW-87-07 | SHEET 1 OF 3

SOIL BORING LOG

PROJECT Caskin Poplar LOCATION NW corner of Freshwater Pond
ELEVATION 912.07 DRILLING CONTRACTOR ETI
DRILLING METHOD AND EQUIPMENT CME 55 4¼" HSA with 3" Split Spoon Sampling
WATER LEVEL AND DATE ______ START 12/4/87 FINISH 12/5/87 LOGGER G. Anderson

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (INCHES)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION NAME, GRADATION OR PLASTICITY, PARTICLE SIZE DISTRIBUTION, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	0-2	grab			Brown silty CLAY (CL-ML), trace sand and gravel, moist.	
	2-4	SB87-07-01	20"	9-12-35-20 (47)	Brown-gray silty CLAY (CL-ML) FILL, trace sand, gravel, and roots, moist, stiff	Water seam (possibly perched) at ~3½'
5	4-6	SB87-07-01	20"	11-20-13-12 (33)	As above	
	6-8	SB87-07-02	18"	6-6-8-7 (14)	As above	
	8-10	SB87-07-02	15"	8-7-18-21 (25)	As above	
10	10-12	SB87-07-03	24"	14-18-22-30 (40)	Brown-gray silty CLAY (ML-CL) TILL, trace sand and gravel, abundant orange iron staining, moist, very stiff	
	12-14	SB87-07-03	15"	20-22-32-29 (54)	As above, gravel content (shale fragments) increases	
14						

1

CH2M HILL

PROJECT NUMBER	BORING NUMBER
	GW-87-07 SHEET 2 OF 3

SOIL BORING LOG

PROJECT ____ LOCATION ____

ELEVATION ____ DRILLING CONTRACTOR ____

DRILLING METHOD AND EQUIPMENT ____

WATER LEVEL AND DATE ____ START ____ FINISH ____ LOGGER ____

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (INCHES)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION NAME, GRADATION OR PLASTICITY, PARTICLE SIZE DISTRIBUTION, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	14-16	SB87-07-04	12"	18-33-55-99 (88)	As above	
16	16-18	SB87-07-04	14"	21-37-46-62 (83)	As above	
	18-20	SS-9	24"	18-35-42-65 (77)	Blue-Gray Silty CLAY (ML-CL) TILL, trace shale chips, mo st, very hard, trace orange iron staining, massive texture	Sand Pack
20	20-22	SS-10	10"	57-106/6"	As above	Sand Pack
	22-24	SB87-07-05	18"	32-110-130/6" (240)	As above	Screened Interval; End of day 12/4
24	24-26	SB87-07-05	6"	100-100/1"	Blue-Gray CLAYSTONE, moderately friable in layers ~1-2" thick As above, grades to a fissile SHALE	Screened Interval
	26-28	SS-13	3"	27-57/4"	As above	Screened Interval
28						

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
W68792.FI	GW-87-06	SHEET 1 OF 2

SOIL BORING LOG

PROJECT Laskin Poplar LOCATION

ELEVATION 920.29 DRILLING CONTRACTOR ETI

DRILLING METHOD AND EQUIPMENT CME 55, 4 1/4" HSA with 3" Split Spoon Sampling

WATER LEVEL AND DATE START 12/17/87 FINISH 12/17/87 LOGGER G. Anderson

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (INCHES)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: NAME, GRADATION OR PLASTICITY, PARTICLE SIZE DISTRIBUTION, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
		grab			Brown silty SAND with gravel, moist	
	2'-4	SB87-06-01	18"	9-9-10-11 (19)	Brown gravelly silty CLAY (CL) FILL with sand, moist, stiff	
5	4-6	SB87-06-01	20"	13-14-16-16 (30)	Brown silty CLAY (CL), trace sand and gravel, moist, very stiff, some gray color, clean fill possibly	
	6-8	SB87-06-02	10"	8-8-9-9 (17)	As above	
	8-10	SB87-06-02	22"	5-6-8-8 (14)	As above, very damp to saturated, medium stiff	
10	10'-12	SB87-06-03	24"	4-5-8-8 (13)	As above	
	12-14	SB87-06-03	24"	5-8-7-8 (15)	As above	
15	14-16	SB87-06-04	24"	4-4-9-8 (13)	As above	Noted a piece of gravel in green silty clay that did not appear to be natural = FILL
	16-18	SB87-06-04	24"	3-4-6-9 (10)	As above	
	18-20	SB87-06-05	24"	4-5-8-11 (13)	As above	Material appears to be FILL to ~30', however there is no clear evidence to indicate fill except at 15'
20	20-22	SB87-06-05	24"	5-7-9-7 (16)	As above	
	22-24	SB87-06-06	24"	8-11-12-15 (23)		
25	24-26	SB87-06-06	24"	13-13-14-24 (27)	Blue-gray and green-gray mottled Silty CLAY (CL), trace sand and gravel (Shale chips), trace wood and roots, moist-very moist, stiff	Sand Pack
	26-28	SS-13	24"	5-6-7-9 (13)	As above, 6-inch brown silty clay seam at 27-27.5'	Screened Interval
	28-30	SS-14	24"	7-10-12-15 (22)	As above	No water observed on drill rods at any sample interval so far
30						

CH2M HILL

PROJECT NUMBER	BORING NUMBER GW-87-06S	SHEET 2 OF 2

SOIL BORING LOG

PROJECT ______ LOCATION ______

ELEVATION ______ DRILLING CONTRACTOR ______

DRILLING METHOD AND EQUIPMENT ______

WATER LEVEL AND DATE ______ START ______ FINISH ______ LOGGER ______

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (INCHES)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: NAME, GRADATION OR PLASTICITY, PARTICLE SIZE DISTRIBUTION, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	30-32	SB87-06-07	24"	4-7-11-26 (18)	Brown silty CLAY (CL), trace sand and gravel, moist, fracturing near base with water in fracture, bottom of till or fill	Screened Interval
	32-34	SB87-06-07	18"	26-33-100/6" (133)	(at 31.5') Brown-Gray Weathered SHALE, moist, orange-brown iron staining on horizontal and vertical surfaces, moderately difficult to crush between fingers, crushes to silt-sized grains	Screened Interval
35	34-36	SB87-06-08	6"	100/6"	As above, horizontal partings occur every ~1/2", and a slight fissility is visible in broken sections	Screened Interval
	36-38	SB87-06-08	4"	100/4"	Dark gray SHALE, fissile, moderately difficult to break with fingers, water observed along partings and fractures over a 2" interval	
40					End of Boring at 39'	

CH2M HILL

PROJECT NUMBER: W68792.FI
BORING NUMBER: GW-87-06D
SHEET 1 OF 1

SOIL BORING LOG

PROJECT: Laskin Poplar
LOCATION: N. of Freshwater Pond
ELEVATION: 919.97
DRILLING CONTRACTOR: ETI
DRILLING METHOD AND EQUIPMENT: CME 55 Rotary Wash with 2 15/16" bit, reamed with 4 7/8" bit
WATER LEVEL AND DATE:
START: 12/19/87
FINISH: 1/6/88
LOGGER: G. Anderson

DEPTH BELOW SURFACE (FT)	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY (INCHES)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: NAME, GRADATION OR PLASTICITY, PARTICLE SIZE DISTRIBUTION, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					0-39' See GW-87-06S log	
40						Driller notes alternating moderate easy to moderate difficult bit advance
	43-45	SS-1	1"	100/2"	Gray SHALE, moist, fissile	
45						Driller notes uniform and easy drilling
	48.5-50.5	SS-2	1"	100/2"	As above	Driller notes alternating moderate difficult (1-2") and moderate easy (2-4") bit advance
50						
	53.5-55.5	SS-3	1"	100/2"	As above	
55					Sand Pack	
	58.5-60.5	SS-4	1"	100/1"	As above	
60					Screened Interval	
	63.5-65.5	SS-5	1"	100/1"	As above	Driller notes uniform and moderate easy bit advance
65					65.2	End of Boring at 70'

CH2M HILL

PROJECT NUMBER	BORING NUMBER GW-87-05	SHEET 3 OF 3

SOIL BORING LOG

PROJECT ______ LOCATION ______
ELEVATION ______ DRILLING CONTRACTOR ______
DRILLING METHOD AND EQUIPMENT ______
WATER LEVEL AND DATE ______ START ______ FINISH ______ LOGGER ______

DEPTH BELOW SURFACE (FT)	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY (~~INCHES~~ FT)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: NAME, GRADATION OR PLASTICITY, PARTICLE SIZE DISTRIBUTION, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	28-30	SB87-05-07	1'	11-5-4-3 (9)	FILL as above	
30	30-32		2'	3-5-6-9 (11)	As above, lower rubble content	Sand Pack
32	32-34	SB87-05-08	2'	8-9-13-14 (22)	As above, Spoon wet	End of day 12/9
34	34-36		2'	5-6-12-12 (18)	As above, sample wet	
36	36-38	SS-18	2'	3-5-18-20 (23)	As above, oily rainbow streaks noted on outside of spoon	
38	38-40	SB87-05-09	1'	100/7"	Gray SHALE, soft, platy, with orange-rust weathered stains along fractures. oil noted on spoon	Screened Interval
40	40-42		1'	100/7"	As above	
42					Auger refusal. Boring open to 41.8'	

CH2M HILL

PROJECT NUMBER	BORING NUMBER
	GW-87-07 SHEET 3 OF 3

SOIL BORING LOG

PROJECT ______ LOCATION ______

ELEVATION ______ DRILLING CONTRACTOR ______

DRILLING METHOD AND EQUIPMENT ______

WATER LEVEL AND DATE ______ START ______ FINISH ______ LOGGER ______

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (INCHES)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION NAME, GRADATION OR PLASTICITY, PARTICLE SIZE DISTRIBUTION, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	28-30	SS-14	6"	135-100/2"	As above	Driller notes easy drilling, cuttings are a gray muck
30	30-32	SS-15	6"	100/3"	As above	
32					Screened Interval	
33					End of Boring at 33.0	

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
W68792.FI	GW-87-08	SHEET 1 OF 2

SOIL BORING LOG

PROJECT Caskn Poplar LOCATION Inside old Pit
ELEVATION 907.26 DRILLING CONTRACTOR ETI
DRILLING METHOD AND EQUIPMENT CME 750, 4¼" HSA with 3" Split Spoon Sampling
WATER LEVEL AND DATE ______ START 12/7/87 FINISH 12/7/87 LOGGER RE Huddleston

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY ~~(INCHES)~~ FT	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION NAME, GRADATION OR PLASTICITY, PARTICLE SIZE DISTRIBUTION, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	0-2	grab			Brown CLAY (CL) FILL, wet	
2	2-4	SB87-08-01	2'	3-3-2-3 (5)	Brown CLAY (CL) FILL, with medium angular brick rubble fragments, wet	
4	4-6		1.5'	1-3-2-2 (5)	As above, oil on some gravel fragments	
6	6-8	SB87-08-02	2'	9-32-38-52 (70)	Gray Silty CLAY (ML-CL) TILL, with subrounded gravel fragments, moist, stiff	Sand Pack
8	8-10		2'	19-22-28-31 (50)	As above, with orange/rust oxidized zones, dry	Screened Interval
10	10-12	SB87-08-03	1'	18-22-31-37 (53)	As above, no rust zones noted, gravel content decreases	
12	12-14		2'	9-29-38-129/5" (67)	Gray SHALE, platy, dry, friable	
14						

CH2M HILL

PROJECT NUMBER	BORING NUMBER
	GW-87-08 SHEET 2 OF 2

SOIL BORING LOG

PROJECT ______ LOCATION ______

ELEVATION ______ DRILLING CONTRACTOR ______

DRILLING METHOD AND EQUIPMENT ______

WATER LEVEL AND DATE ______ START ______ FINISH ______ LOGGER ______

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (~~INCHES~~) (FT)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: NAME, GRADATION OR PLASTICITY, PARTICLE SIZE DISTRIBUTION, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	14-16	SB87-08-04	1'	57-200/5½"	As above, clayey wet smear noted on inside of spoon at ~14'	Screened Interval
16	16-18		1.5'	21-95-120/3"	As above, moist clayey zone noted at 16-16.5'	
18	18-20	SS-9	1'	200/4"	Hard unweathered Shale with clay seam at 19', very wet.	Spoon wet. Very difficult augering at 19'. Auger Refusal at 19.4'
					End of Boring at 19.4'	
20						

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
W68792.FI	GW-87-09	SHEET 1 OF 2

SOIL BORING LOG

PROJECT Laskin Poplar LOCATION

ELEVATION 907.51 DRILLING CONTRACTOR ETI

DRILLING METHOD AND EQUIPMENT CME 750 4 1/4" HSA with 3" Split-Spoon Samples

WATER LEVEL AND DATE START 12/16/87 FINISH 12/16/87 LOGGER RE Huddleston

DEPTH BELOW SURFACE (FT)	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY ~~(INCHES)(FT)~~	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: NAME, GRADATION OR PLASTICITY, PARTICLE SIZE DISTRIBUTION, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
2	2-4	SB87-09-01	1'	4-9-19-15 (28)	Brown silty CLAY (ML-CL) TILL, with subangular gravel, shale chips, roots, and gray mottles, moist	
4	4-6	SB87-09-01	2'	9-13-13-17 (26)	As above, gravel content slightly higher, no root or leaf fragments noted	
6	6-8	SB87-09-02	2'	3-6-6-15 (12)	As above, frequency of mottles decreases, gravel content ~20-30%	
8	8-10	SB87-09-02	2'	19-42-64-69 (106)	As above Gray silty CLAY (ML-CL) TILL, with shale chips, orange-rust colored zones along partings, dry, very stiff	
10	10-12	SB87-09-03	2'	4-25-29-39 (64)	As above, becomes predominantly gray with fewer orange-rust zones	Sand Pack
12	12-14	SB87-09-03	2'	15-28-35-80 (63)	As above	Sand Pack SCREEN
14						SCREEN

CH2M HILL

PROJECT NUMBER	BORING NUMBER GW-87-09 SHEET 2 OF 2

SOIL BORING LOG

PROJECT ______ LOCATION ______
ELEVATION ______ DRILLING CONTRACTOR ______
DRILLING METHOD AND EQUIPMENT ______
WATER LEVEL AND DATE ______ START ______ FINISH ______ LOGGER ______

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (INCHES)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: NAME, GRADATION OR PLASTICITY, PARTICLE SIZE DISTRIBUTION, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	14-16	SB87-09-04	2'	26-51-56-100/.3' (107)	As above	SCREENED INTERVAL
16	16-18		1'	42-100/.3'	As above	
18	18-20	SB87-09-05	1'	100/6"	Gray SHALE, platy wet at 19'	
20	20-22		1'	72-100/.2'	As above, weathered clayey seam extending ~19.5-20.5' (difficult to tell exact boundaries)	
22	22-24	No sample			Drilling 22-24' interval auger cuttings are wet gray silty clayey muck. Drilling became much harder at 24'- auger refusal	
24					End of Boring at 23.7'	

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
W68792.FI	GW-87-11	SHEET 1 OF 1

SOIL BORING LOG

PROJECT Laskin Poplar LOCATION Near EPA treatment Ponds
ELEVATION 322.54 DRILLING CONTRACTOR ETI
DRILLING METHOD AND EQUIPMENT CME 55, 4¼" HSA 3" Split-Spoon Sampling
WATER LEVEL AND DATE ______ START 12/8/87 FINISH 12/8/87 LOGGER G. Anderson

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (INCHES)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION NAME, GRADATION OR PLASTICITY, PARTICLE SIZE DISTRIBUTION, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
		grab			3" crushed stone with brown silty clay Matrix	
	2-4	SB87-11-01	24"	4-8-14-22 (22)	Orange-brown and gray Silty CLAY (CL), trace sand, gravel, and roots, moist, stiff	
	4-6		24"	11-18-22-24 (40)	As above, grades to very stiff no roots	Sand Pack
	6-8	SB87-11-02	20"	8-15-19-29 (34)	As above	Screened Interval
	8-10		16"	16-41-100/4"	As above, grades to a blocky texture	
	10-12	SB87-11-03	24"	42-33-46-58 (79)	Brown + Gray weathered SHALE, trace sand + gravel-sized hard shale fragments in thin layers, blocky to fissile texture with orange iron staining in vertical + horizontal orientations. Very soil-like consistency. with depth becomes more competent	
	12-14		6"	76-100/2"	Moist Shale as above, fissile, grey, individual layers are not easily broken by hand	
	14-16	SS-7	2"	100/2"	As above	Driller notes uniform drilling
	16-18	SS-8	8"	91-100/.25'	As above slightly moist	
	18-20	SS-9	8"	110-100/.25'	As above, slightly moist End of Boring at 18.75'	

PROJECT NUMBER	BORING NUMBER	
W68792.FI	GW-87-11D	SHEET 1 OF 1

SOIL BORING LOG

PROJECT Laskin Poplar LOCATION Nested with GW-87-11
ELEVATION 822.82 DRILLING CONTRACTOR ETI
DRILLING METHOD AND EQUIPMENT CME 55 Rotary Wash with 3 7/8" bit
WATER LEVEL AND DATE ______ START 12/6/87 FINISH 12/6/87 LOGGER K Olson

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (INCHES)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: NAME, GRADATION OR PLASTICITY, PARTICLE SIZE DISTRIBUTION, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
				0-19'	See GW-87-11 Log, one additional split-spoon collected at 14'	Driller notes relatively uniform, moderately difficult drilling 14-19'
20	19-21	SS-2	3	100/3"	Gray SHALE, moist, friable, crumbles into horizontal plates very easily some chalky-looking areas on fracture surfaces	
	21.5-23.5	SS-3	0	100/2.4"		Sand Pack
25	24-25	SS-4	0			
	25-26	SS-5	1"	100/2"	Platy Gray Shale interbedded with soft non-platy shale. Platy shale appears dry. Soft non-platy shale appears moist or saturated	Screened Interval
	26.5-27.5	SS-6	2"	200/3"	As above	
30	29-31	SS-7	2"	200/4"	As above	
	31.5-33.5	SS-8	2"	200/3"	As above	Driller notes very difficult drilling 34-35'
35					End of Boring at 34.9'	

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
W68792.FI	GW-87-13	SHEET 1 OF 1

SOIL BORING LOG

PROJECT Caskin Poplar LOCATION Gravel Road N. of Caskin House

ELEVATION 880.66 DRILLING CONTRACTOR ETI

DRILLING METHOD AND EQUIPMENT CME 55 4¼" HSA 0-12', Rotary wash with 3⅞" bit 12-16.5'

WATER LEVEL AND DATE ______ START 12/3/87 FINISH 12/3/87 LOGGER RE Huddleston

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (INCHES)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: NAME, GRADATION OR PLASTICITY, PARTICLE SIZE DISTRIBUTION, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
		Grab			Brown Well graded GRAVEL (GM) with Silt and Sand	
	2-4	SB87-13-01	8"	7-15-18-19 (33)	Brown-gray silty CLAY (CL-ML) with sand and gravel, moist, stiff	
5	4-6	SB87-13-01	16"	25-79-66-41 (145)	Gray weathered SHALE, with abundant orange staining, slightly moist, very friable, fissility becoming more recognizable with depth	
	6-8	SB87-13-02	18"	24-66-130/5.5"	As above	Sand Pack
	8-10	SB87-13-02	7"	72-100/2"	As above	
10	10-12	SB87-13-03	12"	100-89-100/2"	Gray SHALE with orange iron oxide staining along vertical and horizontal surfaces. Easily friable seams (2-3") occur between harder seams (1"-2") that break easily along vertical and horizontal fractures.	Screened Interval; Auger refusal at 12'. Change to 3⅞" roller bit
15					Gray SHALE, fissile, moderately friable, fresh, dry	
	16-17	SS-6	3"	100/3"	End of Boring at 16.3'	

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
W68792.FI	GW-87-14D	SHEET 1 OF 1

SOIL BORING LOG

PROJECT Laskin Poplar LOCATION Near Cemetery Creek, S. of Creek

ELEVATION 800.75 DRILLING CONTRACTOR ETI

DRILLING METHOD AND EQUIPMENT CME 750, Rotary wash with 4 7/8" bit

WATER LEVEL AND DATE ______ START 1/21/88 FINISH 1/21/88 LOGGER G. Anderson

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (INCHES)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: NAME, GRADATION OR PLASTICITY, PARTICLE SIZE DISTRIBUTION, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	0-1.5	SS-1	18"	pushed	Grayish brown Silty CLAY (CL), trace roots, with abundant iron staining, very damp, soft	
5	4-6	SS-2	24"	29-26-51-79 (77)	Gray SHALE, fissile, damp, easily crushed by hand, vertical fracturing noted 5.5-6'	
						~7-8' Driller notes difficult bit advance 8' Driller notes easier bit advance
10	9-11	SS-3	11"	41-100/5"	Gray SHALE, slightly to moderately fissile, damp, moderately difficult to crush with hands	
					Sand Pack	
15	14-16	SS-4	2"	100/2"	As above	
					Screened Interval	wash cuttings are shale chips
20						21.5-23' Driller notes very difficult bit advance ~23' Driller notes easier bit advance
25					Shale as above	
	25-27	SS-5	1"	100/.05'	End of Boring at 25'	

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
W68792.FI	GW-87-15D	SHEET 1 OF 2

SOIL BORING LOG

PROJECT Laskin Poplar LOCATION N of Cemetery Creek
ELEVATION 257.89 DRILLING CONTRACTOR ETI
DRILLING METHOD AND EQUIPMENT CME 750, Rotary Wash 4½" 0-17', 3⅞" bit 17-25'
WATER LEVEL AND DATE START 12/2/87 FINISH 12/5/87 LOGGER RE Huddleston

DEPTH BELOW SURFACE (FT)	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY (INCHES)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: NAME, GRADATION OR PLASTICITY, PARTICLE SIZE DISTRIBUTION, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
		Grab Sample from auger cuttings			Gray Silty Clay (CL), soft, wet, sticky	
5	4-6	SS-1	1.5'	25-54 100/.3'	Gray shale, very fine grained, slightly softer at top (near 4'), but not weathered to clay - becomes harder with depth.	change to NX coring at 4'
	7.5-9.5'	SS-2	6"	100/6"	As above	See Rock core log for intervals cored
10						
					Sand Pack	
15	13.6-15.6	SS-3	.2'	100/.2'	Dry, soft shale	
	15.9-17.9	SS-4	.3'	125/.3'	Friable grey shale	17.5-20' easy drilling
20	20'-22'	SS-5	.2'	100/.2'	As above	20-21' hard drilling; 21-25' fast, easy drilling
	22.5-24.5	SS-6	.5'	100/.4'	As above, does not appear to be very fractured	
25	25-27'	SS-7	.3'	150/.25'	As above	
					Screened Interval	
					Boring open to 24.7	

CH2M HILL

PROJECT NUMBER	BORING NUMBER	SHEET 2 OF 2
W68792.FI	GW-87-15D	

ROCK CORE LOG

PROJECT Laskin Poplar LOCATION N of Cemetery Creek

ELEVATION DRILLING CONTRACTOR ETI

DRILLING METHOD AND EQUIPMENT CME 750 NX Coring ORIENTATION

WATER LEVEL AND DATE START 12/2/87 FINISH 12/3/87 LOGGER RE Huddleston

Run	DEPTH BELOW SURFACE (FT)	CORE RUN, LENGTH, AND RECOVERY (%)	DISCONTINUITIES: R Q D (%)	FRACTURES PER FOOT	DESCRIPTION: DEPTH, TYPE, ORIENTATION, ROUGHNESS, PLANARITY, INFILLING MATERIAL AND THICKNESS, SURFACE STAINING, AND TIGHTNESS	GRAPHIC LOG	LITHOLOGY: ROCK TYPE, COLOR, MINERALOGY, TEXTURE, WEATHERING, HARDNESS, AND ROCK MASS CHARACTERISTICS	COMMENTS: SIZE AND DEPTH OF CASING, FLUID LOSS, CORING RATE AND SMOOTHNESS, CAVING ROD DROPS, TEST RESULTS, ETC.
1	5.5'–5.9'	.4'/.4' 100%	–	>10	Gray, unweathered shale			
2	5.9'–7.5	.3'/1.6' 19%	–	0				Because rock was soft and recovery poor, split spoons were also collected at certain intervals – See soil boring log
	10.5'							
3	13.7–15.5'	.3'/2.2' 14%	–	0	Dense gray-black shale		Rock is apparently seams of hard, dense shale interlayered with soft, weathered shale.	
	15.9'				Decided to change to Rotary wash drilling at 15.9' – See soil boring log			

Figure 1
ROCK CORE LOG,
FORM 2113A

REV 7/85 FORM D211

CH2M HILL

PROJECT NUMBER	BORING NUMBER
W68792.FI	GW-87-16 D SHEET 1 OF 3

SOIL BORING LOG

PROJECT Laskin Poplar LOCATION N. of Cemetery Creek

ELEVATION 906.64 DRILLING CONTRACTOR ETI

DRILLING METHOD AND EQUIPMENT CME 55, Rotary wash with 4 7/8" bit

WATER LEVEL AND DATE ______ START 1/7/88 FINISH 1/9/88 LOGGER G. Anderson

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (INCHES)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: NAME, GRADATION OR PLASTICITY, PARTICLE SIZE DISTRIBUTION, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
		Grab			Brown Silty CLAY (CL), trace sand and gravel, moist	
5	3.5-5	s-1	6"	7-11-18 (29)	Brown Silty CLAY (CL-ML) TILL, trace sand and gravel, moist, medium dense	
10	8.5-10	ss-2	15"	18-35-43 (78)	As above, with abundant orange-brown iron staining, very dense	
15	13.5-15	ss-3	9"	45-100/3"	Brownish-gray SHALE, moist, with orange-brown and brown-black iron (and possibly magnesium) staining in vertical and horizontal surfaces, very fissile, easily crushed by hand	
20	18.5-20	ss-4	10"	45-79-100/3"	Gray SHALE, slightly moist, very fissile, extremely dense but easily crushed by hand, no fracturing observed	
25	23.5-25	ss-5	3"	100/4"	As above	
						Driller notes uniform and easy bit advance
30	28.5-30	ss-6	2"	100/4"	As above	End of Day 1/7/88

CH2M HILL

PROJECT NUMBER	BORING NUMBER GW-87-16D SHEET 2 OF 3

SOIL BORING LOG

PROJECT ____ LOCATION ____

ELEVATION ____ DRILLING CONTRACTOR ____

DRILLING METHOD AND EQUIPMENT ____

WATER LEVEL AND DATE ____ START ____ FINISH ____ LOGGER ____

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (INCHES)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: NAME, GRADATION OR PLASTICITY, PARTICLE SIZE DISTRIBUTION, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
35	33.5-35	SS-7	2"	100/2"	Shale as above	Driller notes occasional stiff seams (4"-5" thick) in otherwise relatively easy drilling (28.5-38.5'). He also notes occasional softer clayey zones that seem to clog up bit and cause fluid circulation interruptions
40	38.5-40	SS-8	3"	100/3"	as above	Driller notes loss of drilling fluids Since 30', ~500 gal. of drill fluid were loss down the hole
45	43.5-45	SS-9	0"	100/1"		
50	48.5-50	SS-10	0"	100/1"		Substantial drilling fluid loss continues. Driller says bit advancing similar to before
55	53.5-55	SS-11	0"	100/½"		
60	58.5-60	SS-12	0"	100/1"		

CH2M HILL

PROJECT NUMBER	BORING NUMBER GW-87-16D	SHEET 3 OF 3

SOIL BORING LOG

PROJECT ______ LOCATION ______

ELEVATION ______ DRILLING CONTRACTOR ______

DRILLING METHOD AND EQUIPMENT ______

WATER LEVEL AND DATE ______ START ______ FINISH ______ LOGGER ______

DEPTH BELOW SURFACE (FT)	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY (INCHES)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: NAME, GRADATION OR PLASTICITY, PARTICLE SIZE DISTRIBUTION, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
65	63.5-65	SS-13	2"	100/2"	Gray SHALE, slightly moist, fissile with occassional thin layers (1/4"-3/8") of harder shale showing indistinct fissility	Substantial drilling fluid loss continues, Driller notes alternating stiff and less stiff zones approximately every 2'.
70	68.5-70	SS-14	2"	100/2"	As above	
75	73.5-75	SS-15	2"	100/2"	As above	Drilling 45-72' have lost ~1500 gal of drilling fluid. End of day 1-8-88
80	78.5-80	SS-16	2"	100/2"	As above	Drilling continues as above
85	83.5-85	SS-17	0"	100/1"	End of Boring at 85.5'	Drilling 72-85' have lost ~750 gal. drilling fluid downhole

Sand Pack

Screened Interval

CH2M HILL

PROJECT NUMBER	BORING NUMBER
W68792.FI	GW-87-17D SHEET 1 OF 1

SOIL BORING LOG

PROJECT Laskin Poplar LOCATION Near Cemetery Creek N. of Creek

ELEVATION 862.36 DRILLING CONTRACTOR ETI

DRILLING METHOD AND EQUIPMENT CME 750, Rotary Wash with 4 7/8" b.t

WATER LEVEL AND DATE ______ START 1/23/88 FINISH 1/23/88 LOGGER G. Anderson

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (INCHES)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: NAME, GRADATION OR PLASTICITY, PARTICLE SIZE DISTRIBUTION, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
		Grab			Brown-gray silty CLAY (CL), trace roots, soft, moist	
5	5-6.5	SS-1	13"	22-71-100/1"	Gray SHALE, damp, fissile, easily crushed by hand	Driller notes difficult b.t advance at 6'. Circulating water has sewer odor
10	10-11.5	SS-2	10"	90-100/4"	As above	Driller notes easy b+ advance 12.5-14', difficult b.t advance 14-15', slightly easier 15-20'
					Sand Pack	
15	15-16.5	SS-3	5"	100/5"	As above	
20	20-21.5	SS-4	10"	17-1-22-15	As above	At 22.5' Driller notes moderately difficult bit advance
					Screened Interval	
25	25-26.5	SS-5	0"	50/0"	End of Boring at 25.0	

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
W68792.FI	GW-87-18	SHEET 1 OF 1

SOIL BORING LOG

PROJECT Laskin Poplar LOCATION New Fairgrounds

ELEVATION 918.65 DRILLING CONTRACTOR ETI

DRILLING METHOD AND EQUIPMENT CME 55 4¼" HSA with 3" Split Spoon Sampling

WATER LEVEL AND DATE START 12/2/87 FINISH 12/2/87 LOGGER G. Anderson

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (INCHES)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION NAME, GRADATION OR PLASTICITY, PARTICLE SIZE DISTRIBUTION, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
		Grab			Dark brown Silty CLAY (CL-ML)	
	2-4	SS-1	24"	6-10-13-27 (23)	Brown and gray Silty CLAY (ML-CL) TILL, trace sand and fine gravel (predominantly shale chips) moist, very stiff	
5	4-6	SS-2	10"	6-10-13-18 (23)	As above	
	6-8	SS-3	18"	13-25-37-55 (62)	As above	Sand Pack
	8-10	SS-4	24"	9-22-31-36 (53)	As above, gravel is fine-medium	
10	10-12	SS-5	20"	16-27-38-42 (65)	Gray Silty CLAY (ML-CL) TILL, trace sand and gravel (subangular shale), moist, very stiff	Screened Interval
	12-14	SS-6	20"	15-22-32-41 (54)	6" moist-wet silty seam at 13.5-14'	
15	14-16	SS-7	14"	8-13-24-42 (37)	Gray TILL as above, with moist-wet sandy SILT seam at 15-15.5'	Cuttings dry at 16'
	16-18	SS-8	9"	100-100/3"	Gray SHALE, fissile, easily broken by hand	
	18-20	SS-9	1"	150/5"	As above	
20	20-22	SS-10	½"	71/4"-100/4"	As above	
					End of boring at 20.7'	

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
W68793.FI	GW-87-19A	SHEET 1 OF 2

SOIL BORING LOG

PROJECT Laskin Poplar LOCATION Near GW-008
ELEVATION 901.71 DRILLING CONTRACTOR ETI
DRILLING METHOD AND EQUIPMENT CME 750 Rotary Wash with 3 7/8" bit
WATER LEVEL AND DATE ______ START 12/19/87 FINISH 1/9/88 LOGGER RE Huddleston

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (INCHES)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: NAME, GRADATION OR PLASTICITY, PARTICLE SIZE DISTRIBUTION, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					0-24' not logged - See log of Adjacent existing well GW-008 for stratigraphy Shale encountered at ~22'	
20'						
24'	24-26	1	0.5'	100/.3'	Gray Shale, soft, friable, with clay in small seams (<.5cm)	
30	29-31	2	—	100/.1'	No recovery	
35	34-36	3	.3'	100/.15'	Shale as above	
40	39-41	4	.2'	100/.1'	Shale as above	
45	44-46	5	.1'	100/.1'	Shale as above	

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
W68793.FI	GW-87-19D	SHEET 2 OF 2

SOIL BORING LOG

PROJECT ______ LOCATION ______

ELEVATION ______ DRILLING CONTRACTOR ______

DRILLING METHOD AND EQUIPMENT ______

WATER LEVEL AND DATE ______ START ______ FINISH ______ LOGGER ______

DEPTH BELOW SURFACE (FT)	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY (INCHES)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: NAME, GRADATION OR PLASTICITY, PARTICLE SIZE DISTRIBUTION, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL		COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
45						Sand Pack	
50	49-51	6	–	100/.1'	No recovery	Screened Interval	
55	54-56	7	.1'	100/.1'	Shale as above, harder		
60					60.2 End of Boring		

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
W68792.FI	SB-87-02	SHEET 1 OF 2

SOIL BORING LOG

PROJECT Laskin Poplar LOCATION Exclusion Zone, off decon pad

ELEVATION 916' DRILLING CONTRACTOR ETI

DRILLING METHOD AND EQUIPMENT CME 55, 4 1/4" HSA with 3" Split-Spoon Samples

WATER LEVEL AND DATE ______ START 12/9/87 FINISH 12/9/87 LOGGER G. Anderson

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (INCHES)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: NAME, GRADATION OR PLASTICITY, PARTICLE SIZE DISTRIBUTION, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
2	2-4	SB87-02-01	4"	10-62-27-21 (89)	Brown-black Silty SAND and gravel (SM) FILL, gravel is shale, limestone and concrete, moist	
4	4-6	SB87-02-01	18"	14-22-22-21 (44)	Brown and gray silty CLAY (ML-CL) FILL, trace sand and gravel, including coal/cinders, asphalt, slag, moist	
6	6-8	SB87-02-02	18"	13-18-23-30 (41)	Brown and gray silty CLAY (ML-CL), trace sand and gravel, moist, very stiff	
8	8-10	SB87-02-02	20"	11-13-16-26 (29)	As above, grades to brown	
10	10-12	SB87-02-03	24"	11-21-26-34 (47)	As above, becoming harder with depth	
12	12-14	SB87-02-03	24"	20-32-70-110 (102)	Gray-Brown Weathered SHALE, with orange-brown staining along horizontal partings. Partings are undulatory and occur every 1/4" to 1/2". Very soil-like consistency	
14						

PROJECT NUMBER	BORING NUMBER SB-87-02 SHEET 2 OF 2

SOIL BORING LOG

PROJECT ______ LOCATION ______

ELEVATION ______ DRILLING CONTRACTOR ______

DRILLING METHOD AND EQUIPMENT ______

WATER LEVEL AND DATE ______ START ______ FINISH ______ LOGGER ______

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (INCHES)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION NAME, GRADATION OR PLASTICITY, PARTICLE SIZE DISTRIBUTION, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	14-16	SB87-02-04	18"	38-48-112 (160)	SHALE as above, grades to slightly brittle, with lenses of gray weathered shale and orange staining along vertical surfaces also	
16	16-18		18"	17-48-144 (192)	As above	
18	18-20	SB87-02-05	8"	31-125	As above	
20	20-22'		6"	137	As above, with very little orange-brown staining	
					End of Boring at 20.5'	

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
W68792.FI	SB-87-04	SHEET 1 OF 2

SOIL BORING LOG

PROJECT Laskin Poplar LOCATION Near 6W-204

ELEVATION 906' DRILLING CONTRACTOR ETI

DRILLING METHOD AND EQUIPMENT CME 55, 4 1/4" HSA with continuous Split-spoon Sampling

WATER LEVEL AND DATE ______ START 12/10/87 FINISH 12/10/87 LOGGER G. Anderson

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (INCHES)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: NAME, GRADATION OR PLASTICITY, PARTICLE SIZE DISTRIBUTION, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
		Grab			Brown Silty Sand and gravel, moist	
2	2-4	SB87-04-01	15"	16-6-6-8 (12)	Brown Silty CLAY (ML-CL) FILL, trace sand and gravel (shale, concrete), moist, stiff	
4	4-6	SB87-04-01	18"	6-13-21-18 (34)	As above, encountered a 2" seam of oil saturated sand and gravel	
6	6-8	SB87-04-02	12"	7-6-4-5 (10)	As above	
8	8-10	SB87-04-02	18"	3-4-5-7 (9)	As above, encountered a 1" oil saturated organic seam (grass)	
10	10-12	SB87-04-03	15"	4-5-8-7 (13)	Brown Silty CLAY (ML-CL) interlaminated with (every 1-2MM) a black, shiny tar/sludge-like material. Glass fragments were also noted.	
12	12-14	SB87-04-03	18'	5-8-16-22 (24)	Brown and gray Silty CLAY (ML-CL), trace sand and gravel (shale), moist, very stiff	Outside of spoon was covered with a black muck.
14						

CH2M HILL

PROJECT NUMBER	BORING NUMBER SB-87-04	SHEET 2 OF 2

SOIL BORING LOG

PROJECT ____ LOCATION ____

ELEVATION ____ DRILLING CONTRACTOR ____

DRILLING METHOD AND EQUIPMENT ____

WATER LEVEL AND DATE ____ START ____ FINISH ____ LOGGER ____

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (INCHES)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION NAME, GRADATION OR PLASTICITY, PARTICLE SIZE DISTRIBUTION, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	14-16	SB87-04-04	24"	9-20-29-36 (49)	As above	
16	16-18		24"	14-22-24-37 (46)	Gray weathered SHALE, with orange-brown staining along horizontal and vertical surfaces, moist, soil-like consistency	0.1 product noted on rods after pulling spoon
18	18-20	SB87-04-05	14"	18-67-100/3"	Gray SHALE, well lithified at base (can't be broken with hands), slightly moist	
20	20-22	SB87-04-06	14"	8-36-106/6" (142)	Brown-gray SHALE with abundant orange-brown stains on horizontal and vertical surfaces, moist, friable	
22					End of Boring at 21.5'	

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
W68792. FI	SB-87-12	SHEET 1 OF 1

SOIL BORING LOG

PROJECT Lockin Poplar LOCATION N. end of Retention Pond

ELEVATION 907' DRILLING CONTRACTOR CTI

DRILLING METHOD AND EQUIPMENT CME 750, 4 1/4" HSA with 3" Split-Spoon Sampling

WATER LEVEL AND DATE ______ START 12/18/87 FINISH 12/18/87 LOGGER RE Huddleston

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY ~~(INCHES)~~ FT	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION NAME, GRADATION OR PLASTICITY, PARTICLE SIZE DISTRIBUTION, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
		grab			Brown silty CLAY (CL)	
	2-4	SB87-12-01	2'	11-12-11-12 (23)	Gray SILT (ML) FILL with clay, angular gravel fragments, organic matter (wood, grass, roots), and brown mottles, stiff, dry	
5	4-6		1.8'	9-11-14-13 (25)	As above	
	6-8	SB87-12-02	2'	9-9-9-9 (18)	As above, moist	
	8-10		6"	4-11-8-6 (19)	As above	
10	10-12	SB87-12-03	1.8'	5-6-5-7 (11)	As above	
	12-14		1'	4-11-7-7 (18)	As above, higher wood content	
15	14-16	SB87-12-04	1'	14-7-6-6 (13)	As above, with concrete rubble	
	16-18		2'	4-5-6-7 (11)	As above, mostly brown color with gray streaks, high wood content, no concrete rubble noted	
	18-20	SB87-12-05	2'	3-5-6-10 (11)	As above	
20	20-22		2'	3-10-13-18 (23)	Brown Silty CLAY (ML-CL) TILL, with angular gravel (shale) and gray mottles, slightly moist, slightly stiff	
	22-24	SB87-12-06	2'	13-10-17-21 (27)	As above	
25	24-26		2'	7-13-20-26 (33)	As above	
	26-28	SS-13	2'	16-41-59-100/.2' (100)	Gray weathered SHALE, with rust stains along fractures, some seams along fractures had weathered to clay, dry.	
30	28-30	SS-14	1'	100/6"	As above, Shale becoming more competent with depth, dry.	End of Boring at 30'

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
W68792.FI	SB-87-10	SHEET 1 OF 1

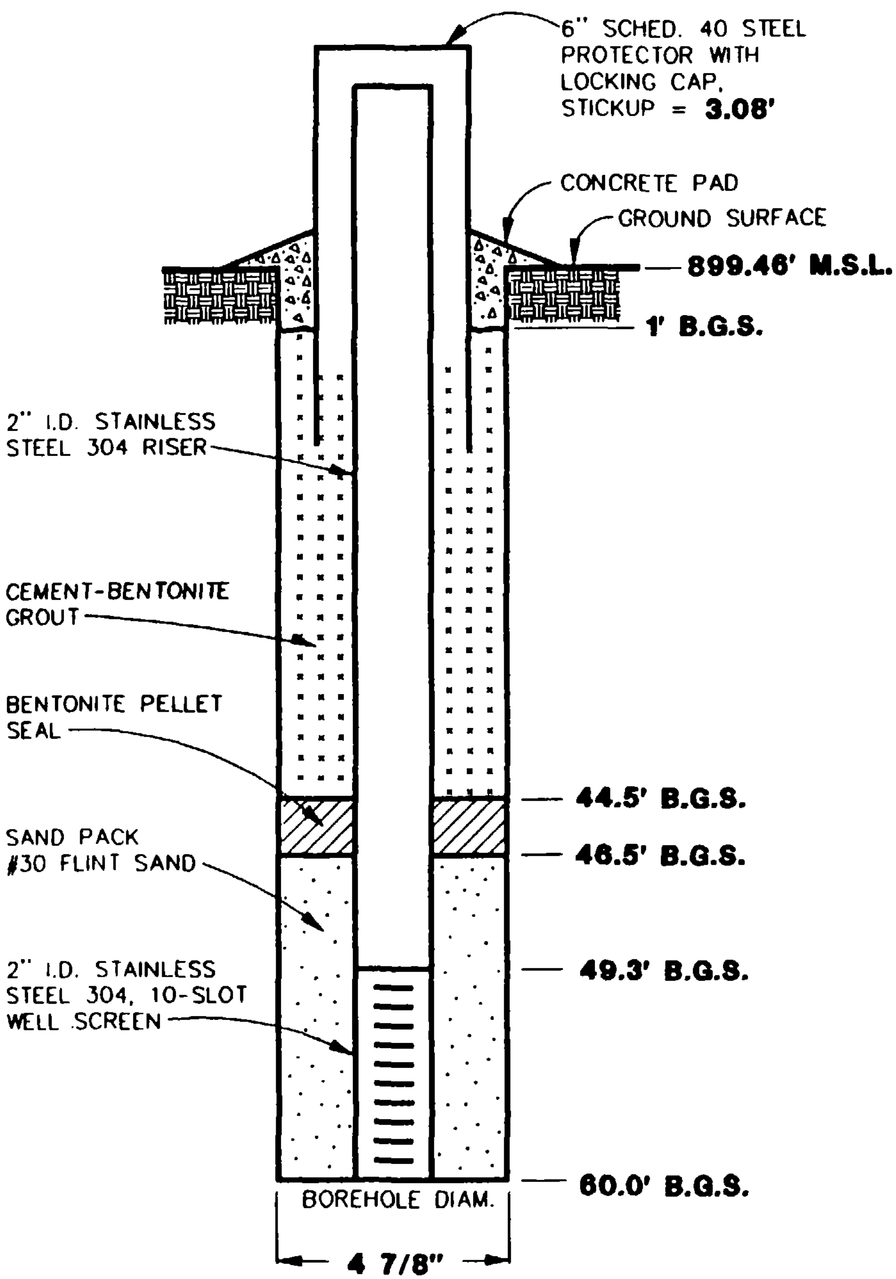
SOIL BORING LOG

PROJECT Laskin Poplar LOCATION Exclusion Zone, filled pit
ELEVATION 903' DRILLING CONTRACTOR ETI
DRILLING METHOD AND EQUIPMENT CME 750, 4 1/4" HSA with 3" Split-Spoon Sampling
WATER LEVEL AND DATE ______ START 12/8/87 FINISH 12/8/87 LOGGER RE Huddleston

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION NAME, GRADATION OR PLASTICITY, PARTICLE SIZE DISTRIBUTION, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	0-2	grab			Brown Clayey Fill	
	2-4	SB87-10-01	1.2'	4-3-4-4 (7)	Brown-gray CLAY (CL) FILL, with fine gravel, soft, wet	
5	4-6	SB87-10-01	1.2'	1-2-1-2 (3)	As above, with wood and grass fragments, gravel content slightly lower, with orange/rust mottles	
	6-8	SB87-10-02	2'	1-2-2-3 (4)	As above, with a piece of electrical wire, soil is very sticky	
10	8-10	SB87-10-02	1.2'	3-2-2-2 (4)	As above	
	10-12	SB87-10-03	1.8'	1/12"-2-4 (3)	As above, gravel content ~20%	
	12-14	SB87-10-03	2'	2-3-2-2 (5)	As above	
15	14-16	SB87-10-04	1.5'	2-2-2-3 (4)	As above	
	16-18	SB87-10-04	1'	1/12"-2-2 (3)	Black, sludge-like CLAY (CL), very sticky, wet	
	18-20	SB87-10-05	1'	87-100/3"	Gray weathered SHALE, platy, fractured with orange-rust oxidation along fractures, soft, wet at 18', becoming drier with depth	
20	20-22	SB87-10-05	1'	79-100/3"	As above	
					End of Boring at 22'	

Appendix B-4
ATTACHMENT 2
WELL CONSTRUCTION DIAGRAMS

W68792.R2\SET1 6/3/88



GW-87-01D
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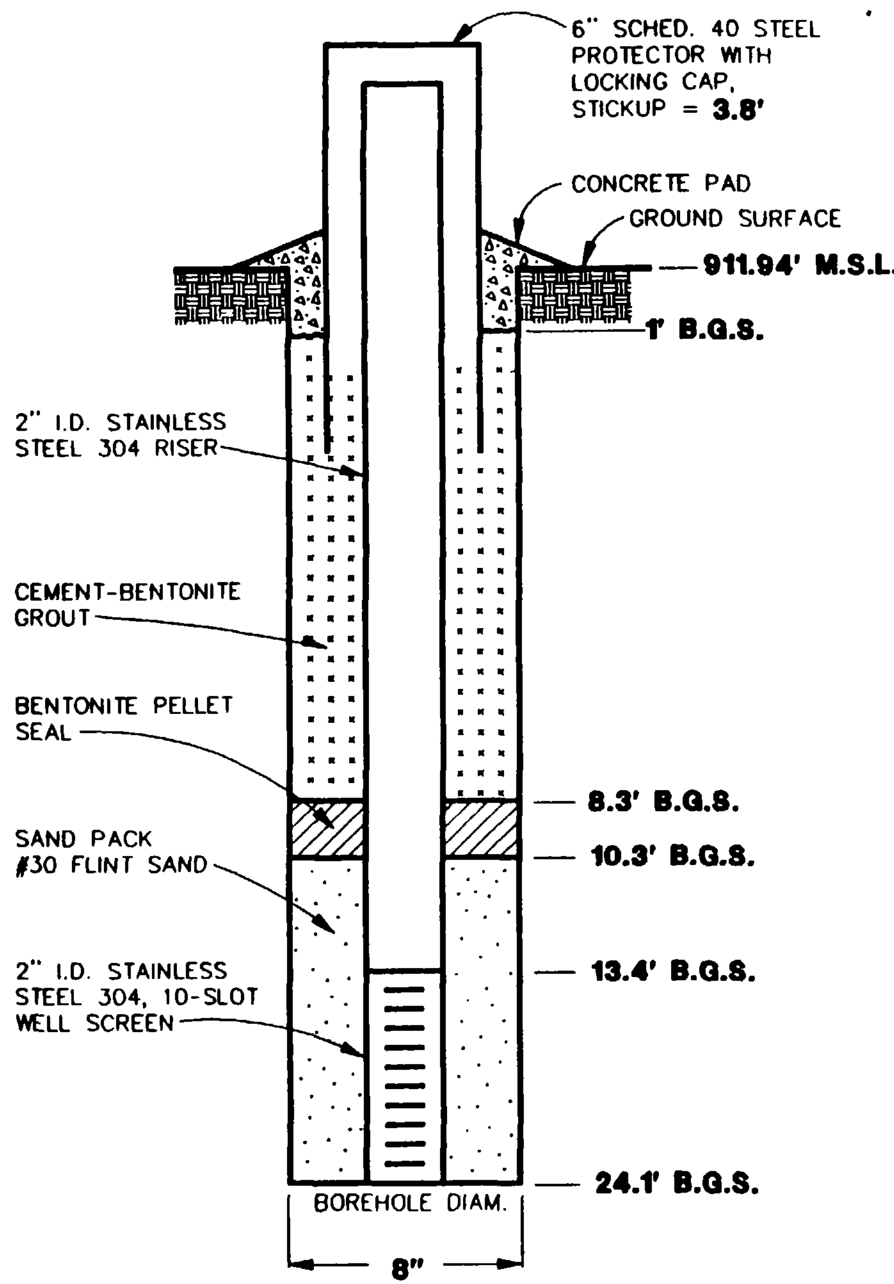

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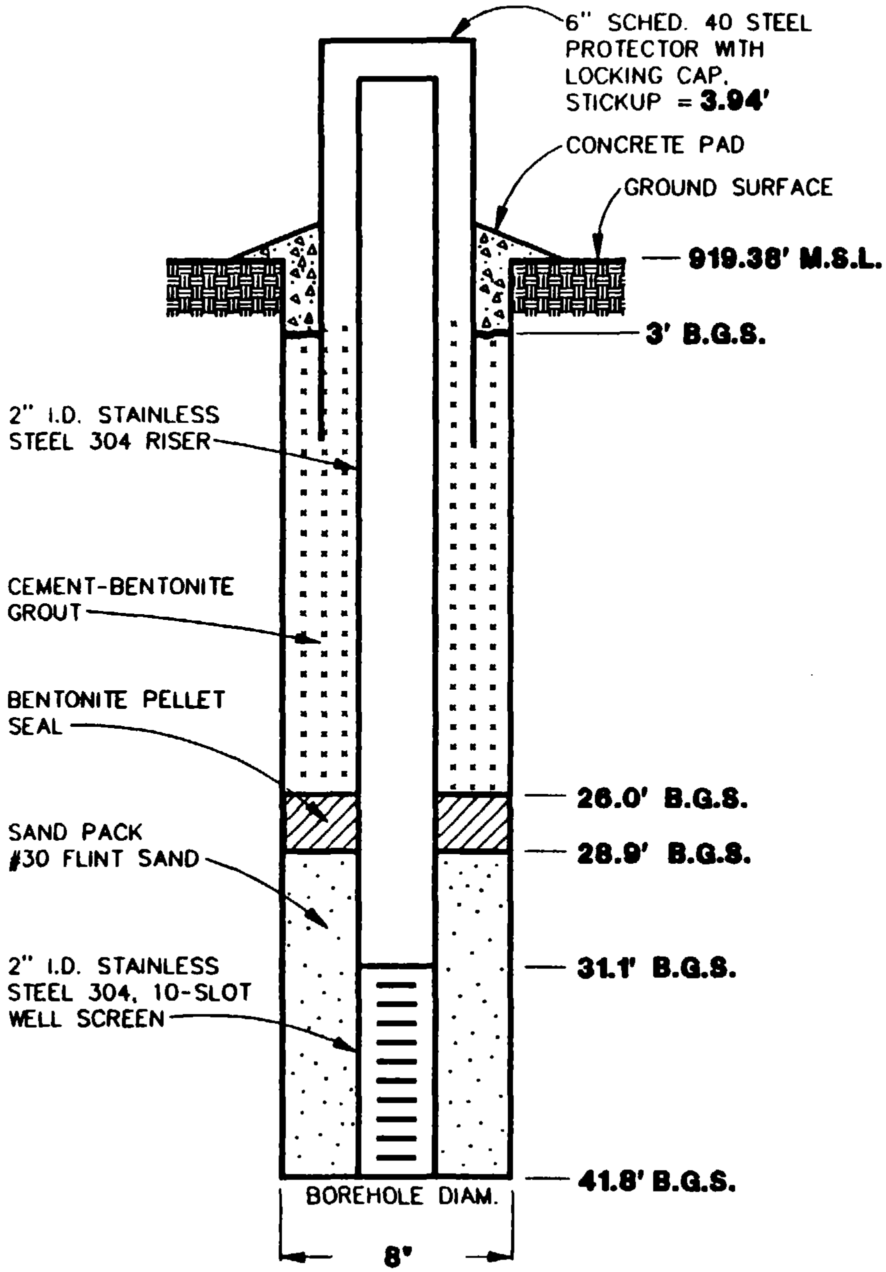
NOT TO SCALE

B.G.S. = BELOW GROUND SURFACE



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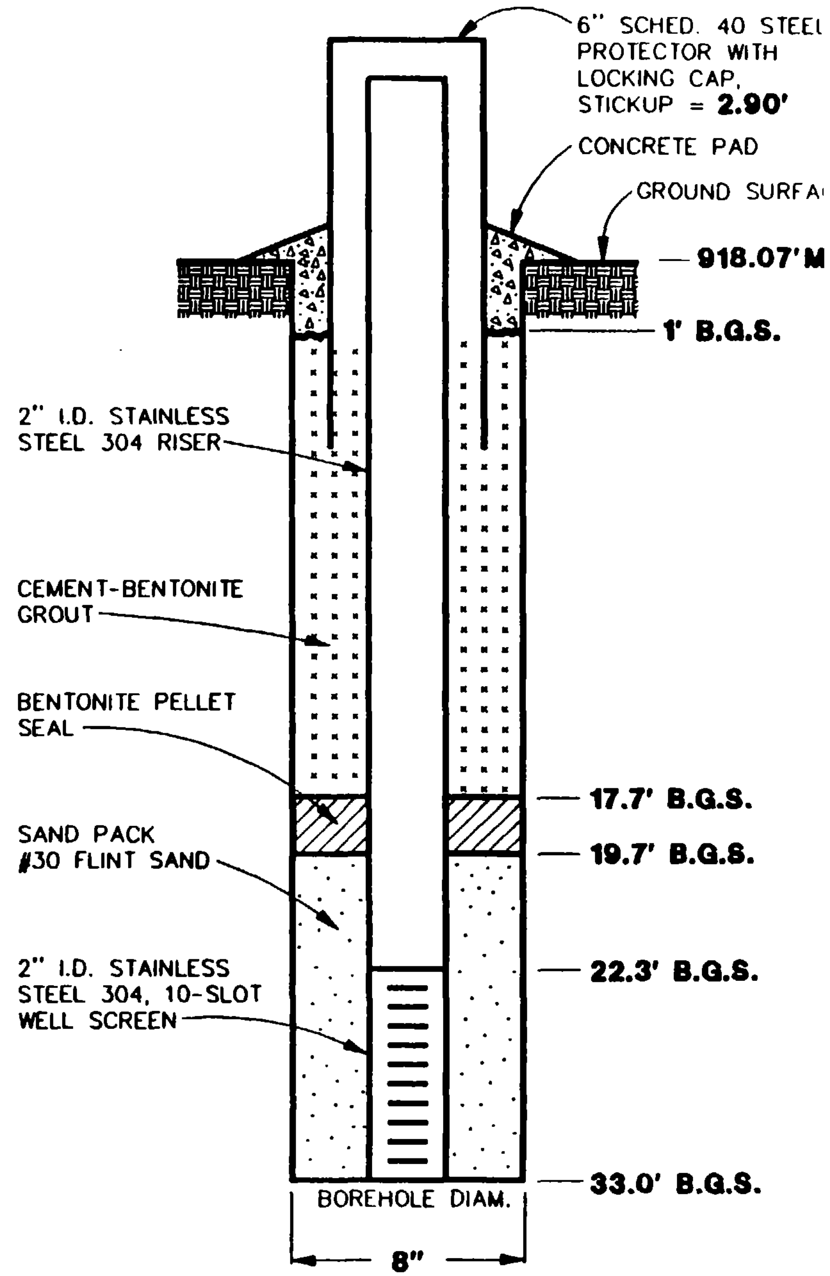
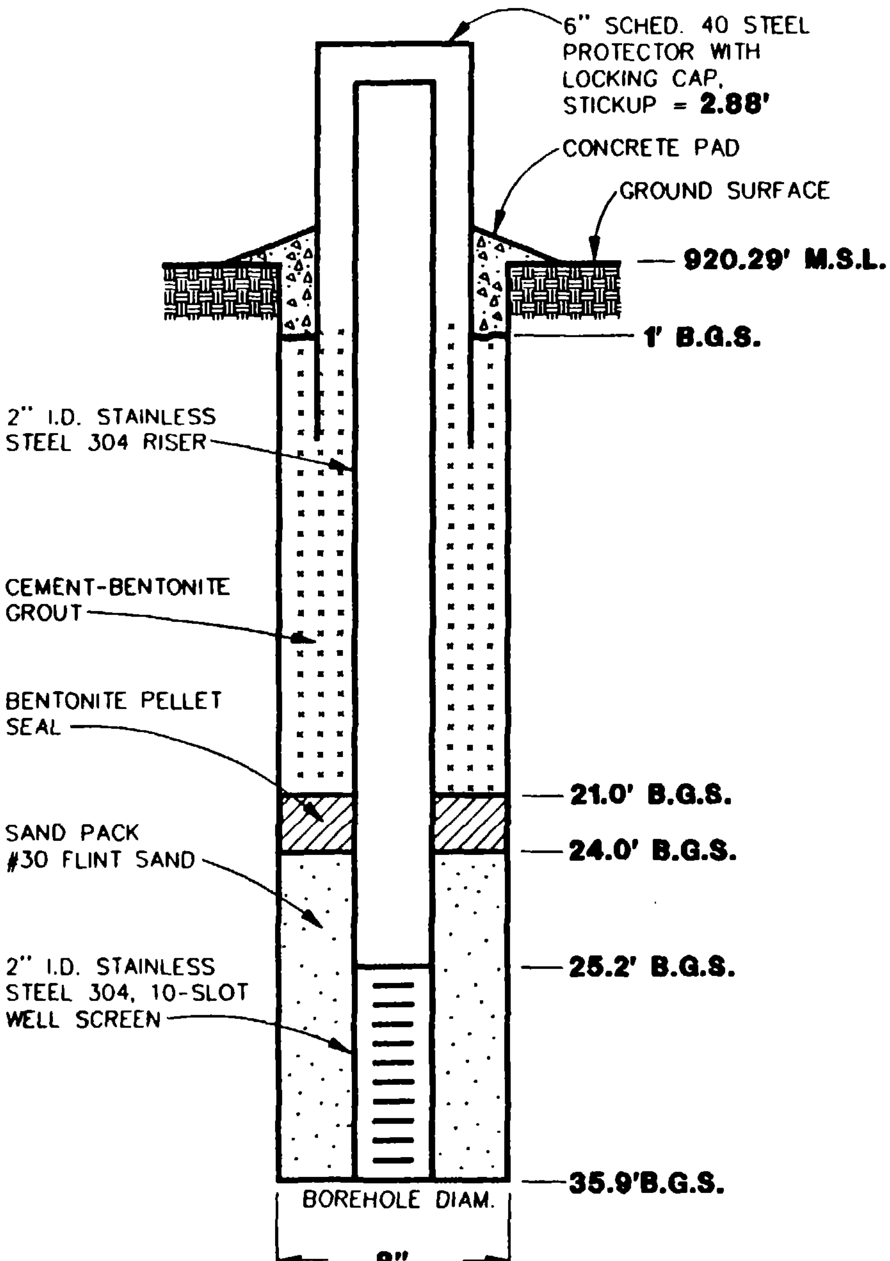


GW-87-07

NOT TO SCALE

B.G.S. = BELOW GROUND SURFACE

W88792.R2\SET3 5/19/88



GW-87-06

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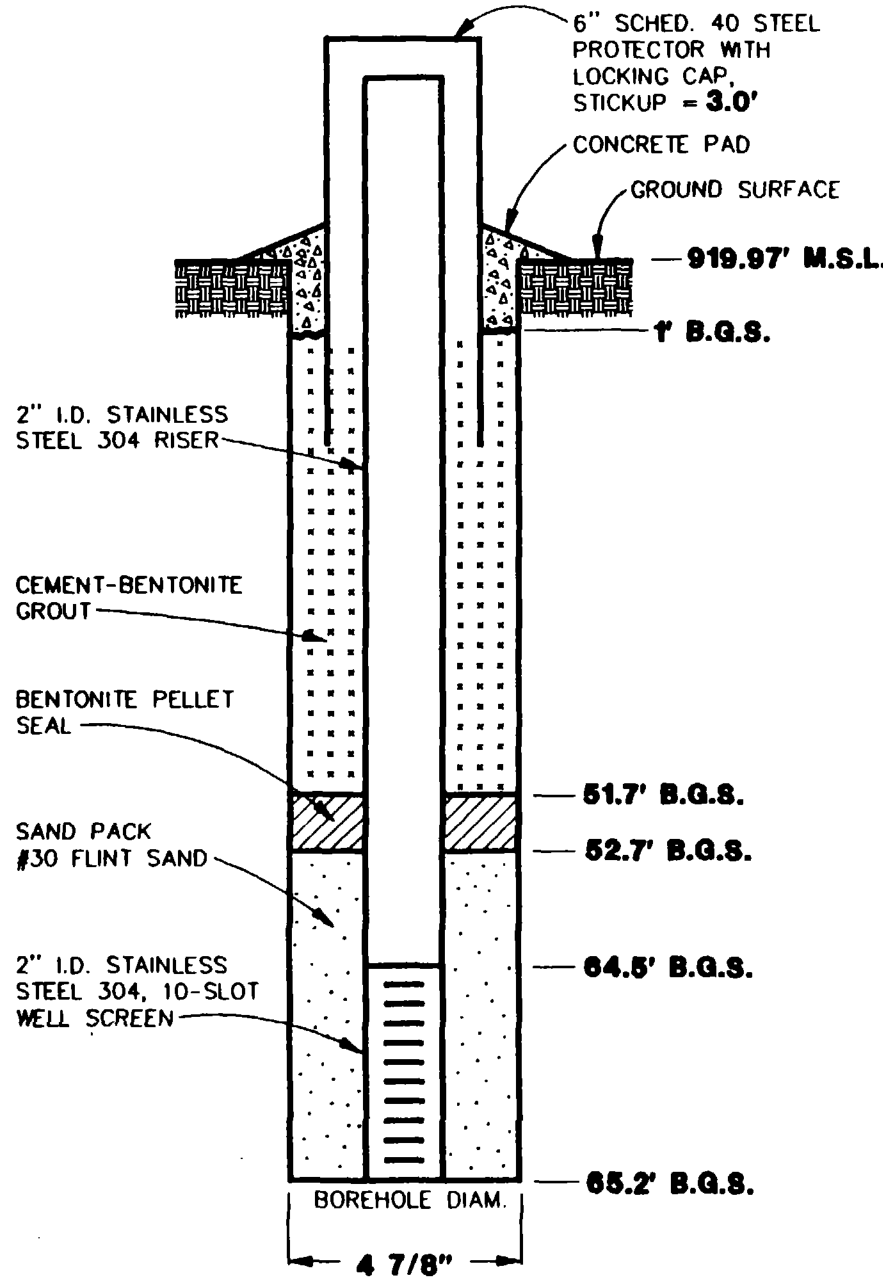
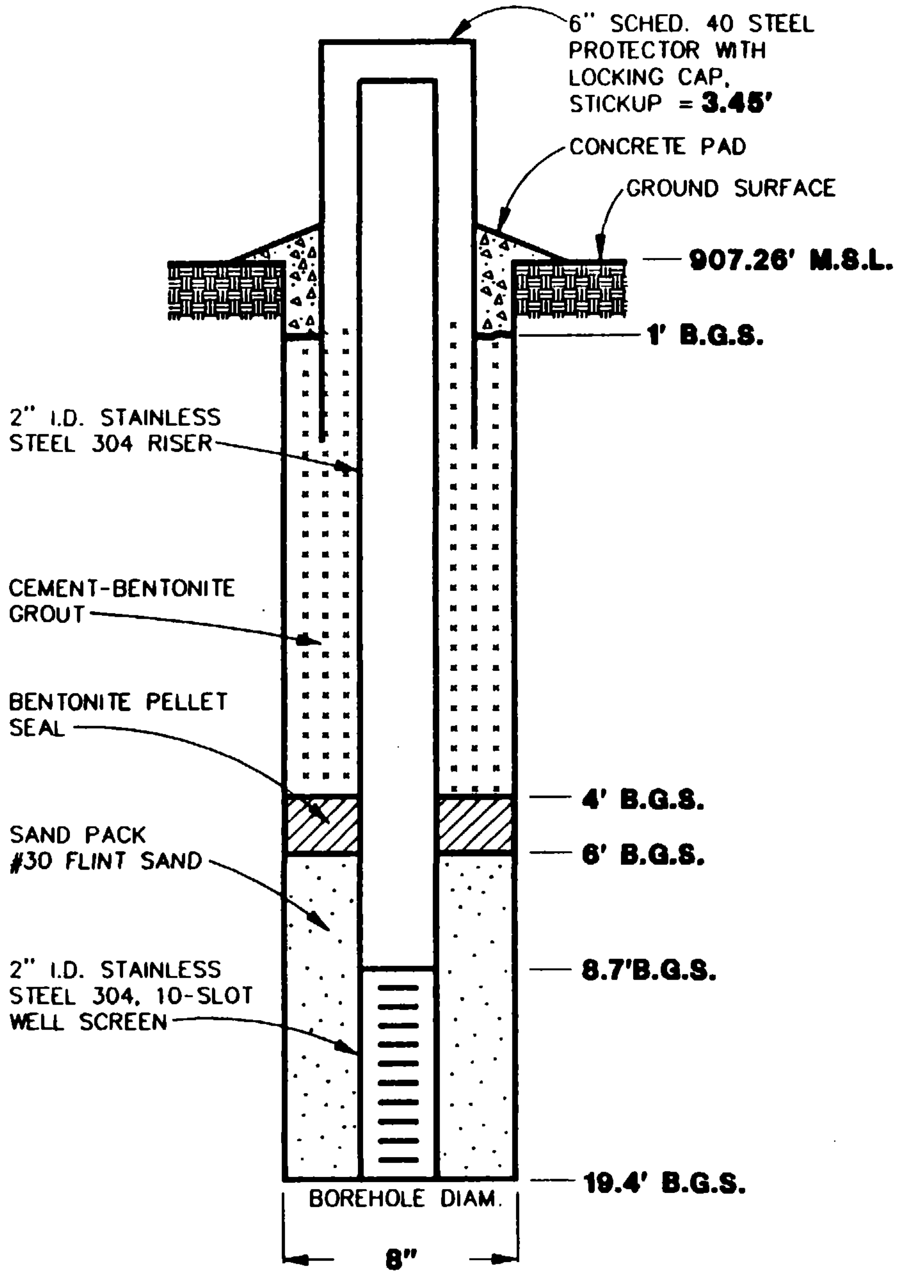


GW-87-06D

NOT TO SCALE

B.G.S. = BELOW GROUND SURFACE



GW-87-08

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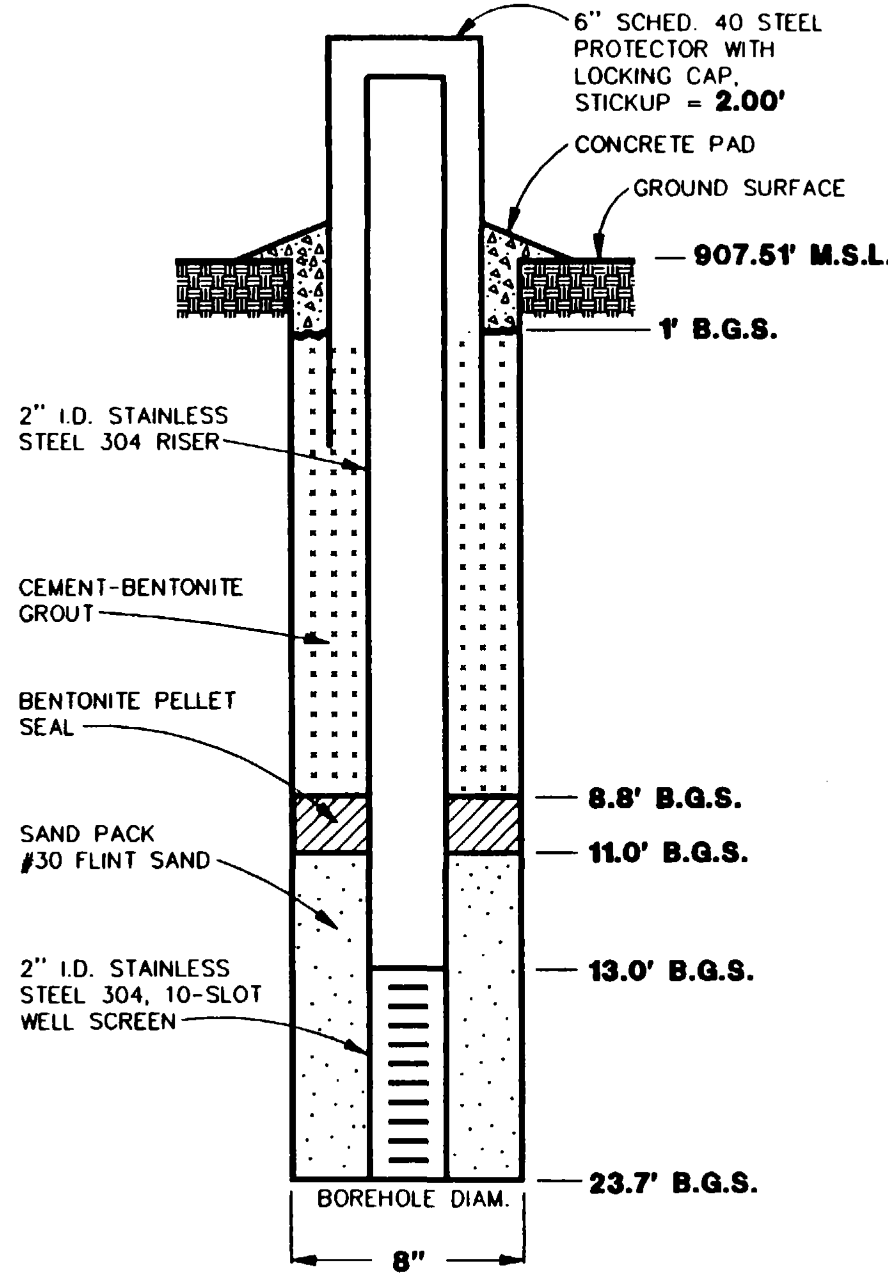
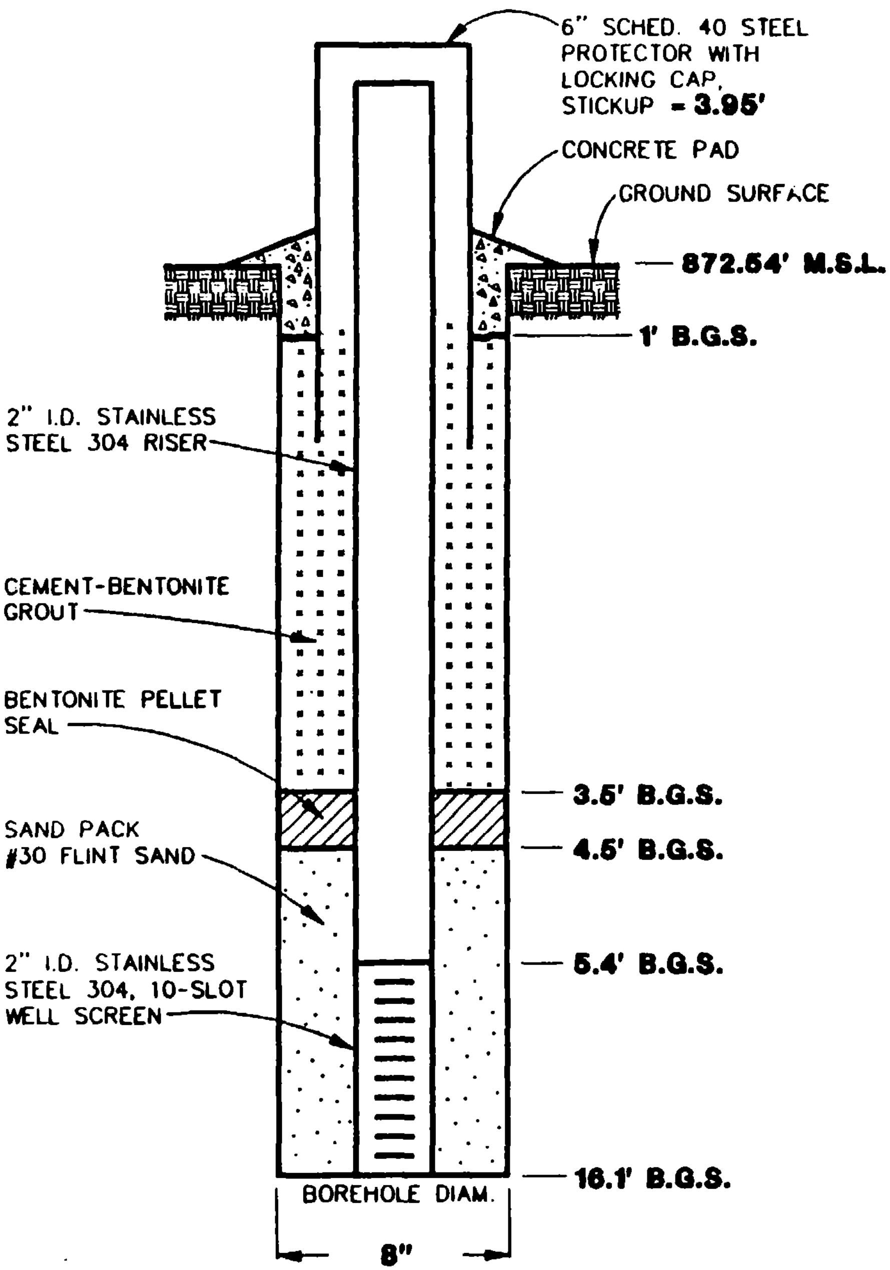


GW-87-09

NOT TO SCALE

B.G.S. = BELOW GROUND SURFACE

W68792.R2/SET4 5/26/88



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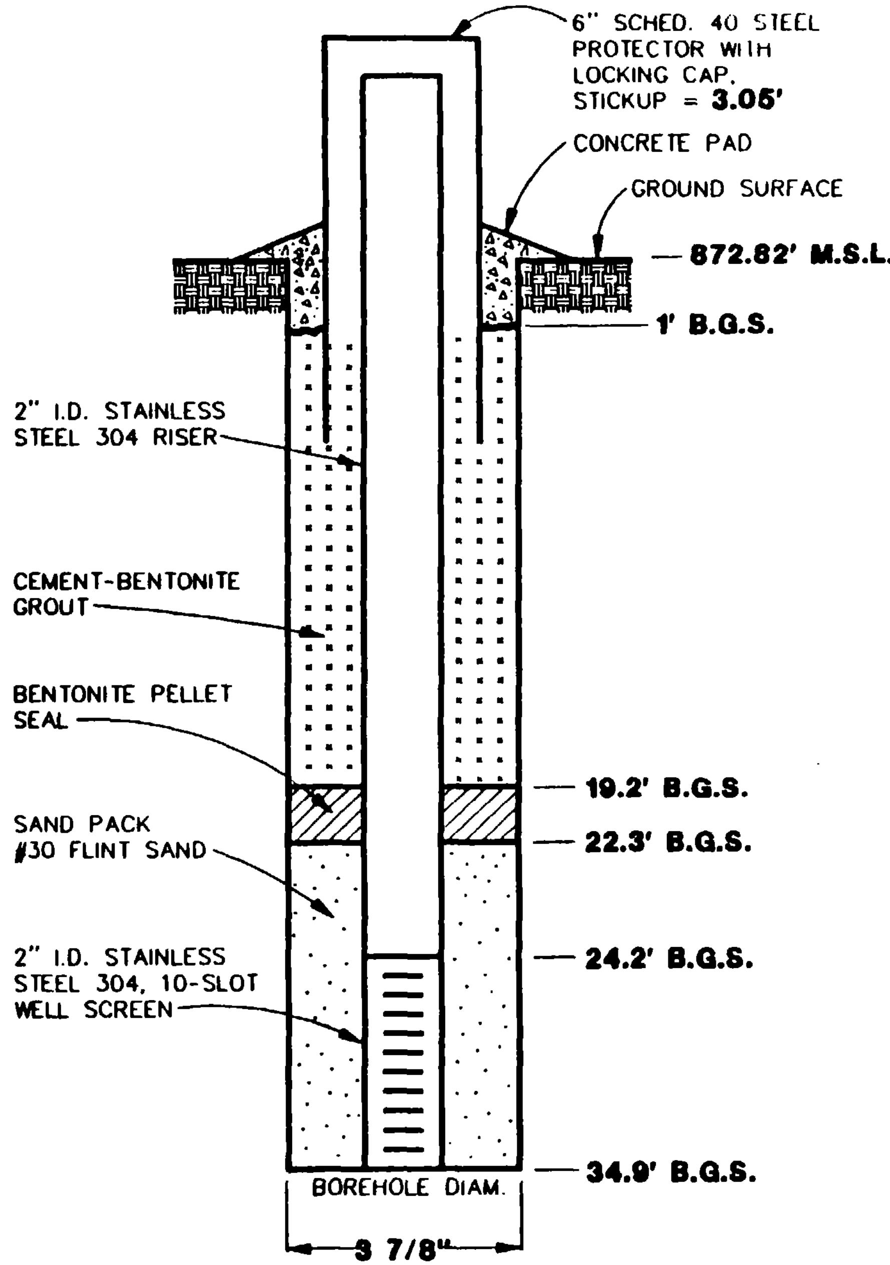
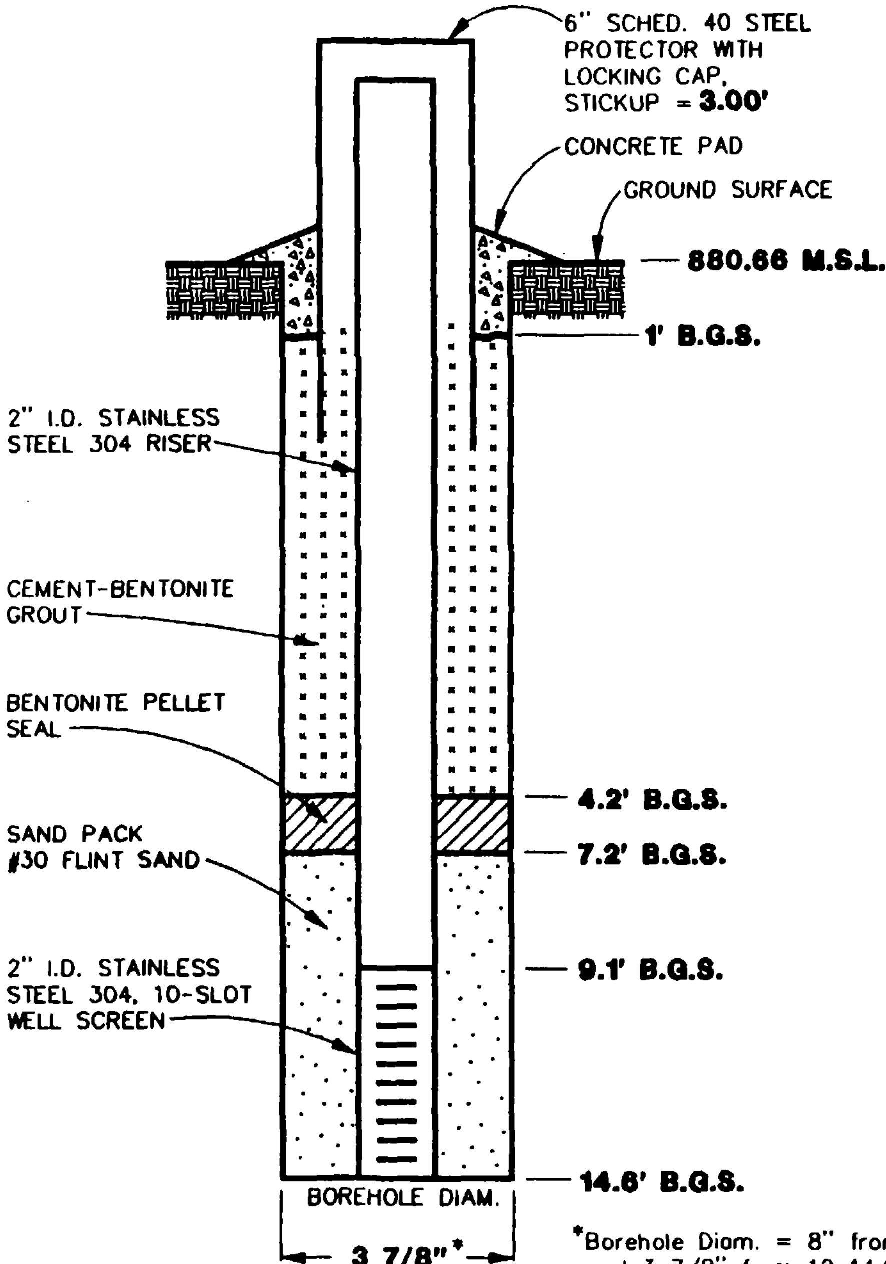


GW-87-11D

NOT TO SCALE

B.G.S. = BELOW GROUND SURFACE

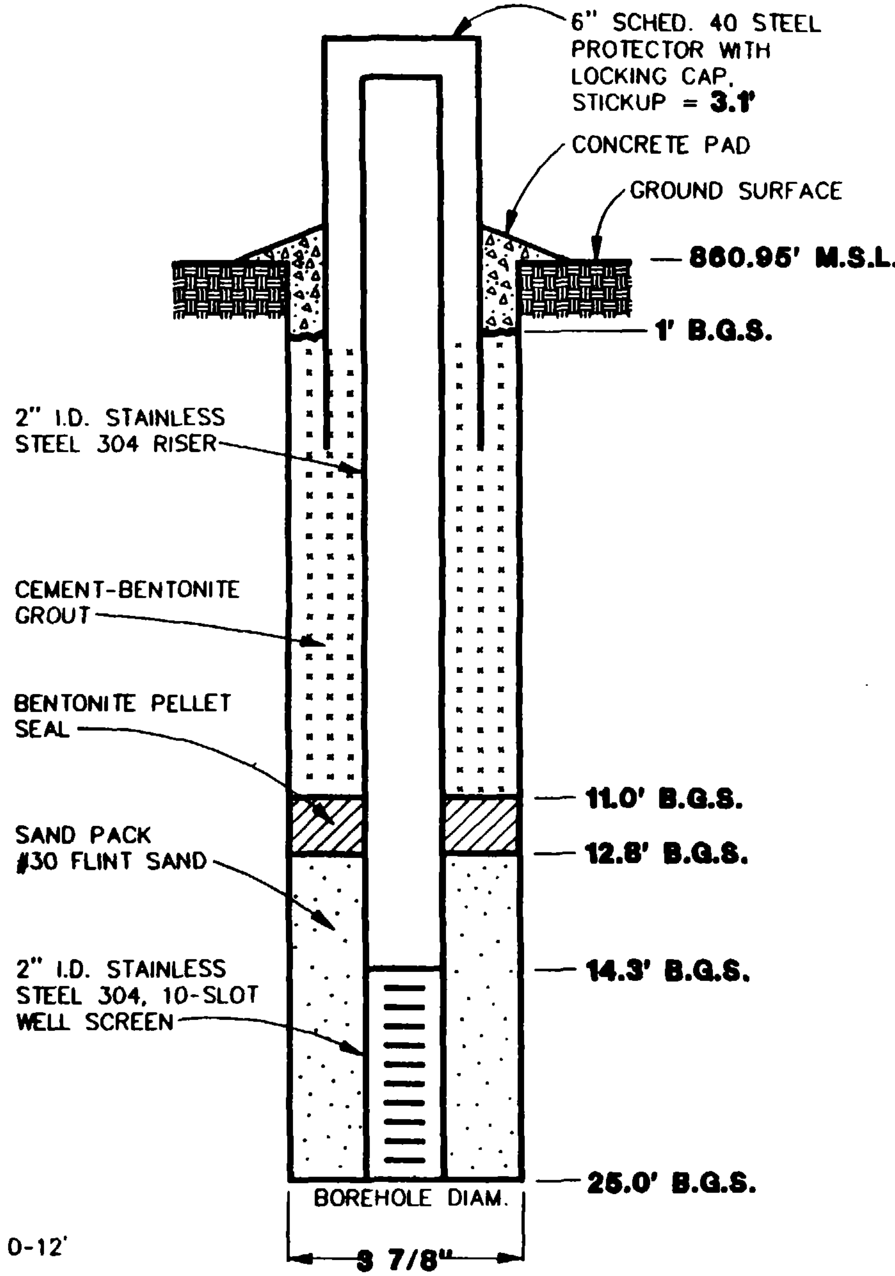


*Borehole Diam. = 8" from 0-12' and 3 7/8" from 12-14.6'.

GW-87-13

NOT TO SCALE

B.G.S. = BELOW GROUND SURFACE



GW-87-14D

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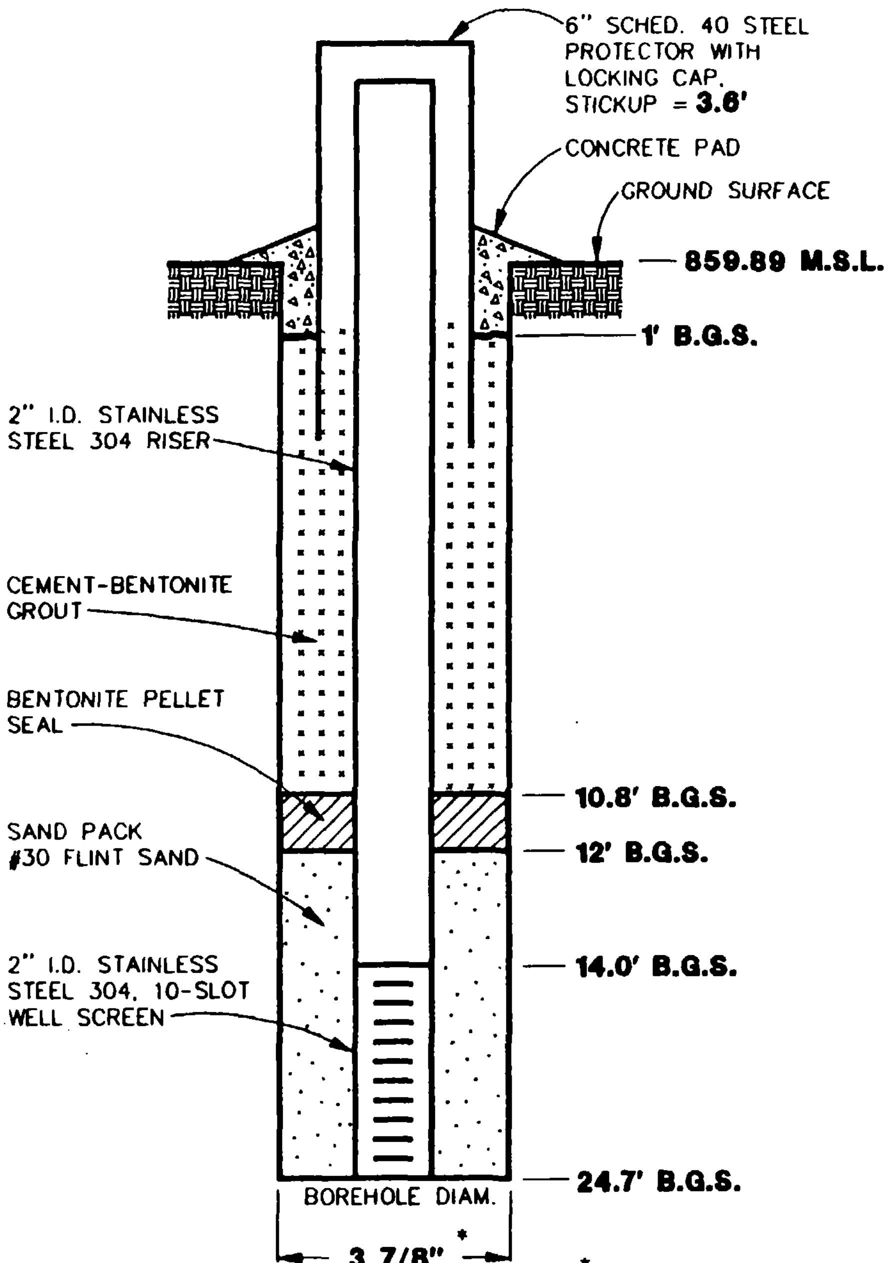
W68792.R2\SET7 6/2/88



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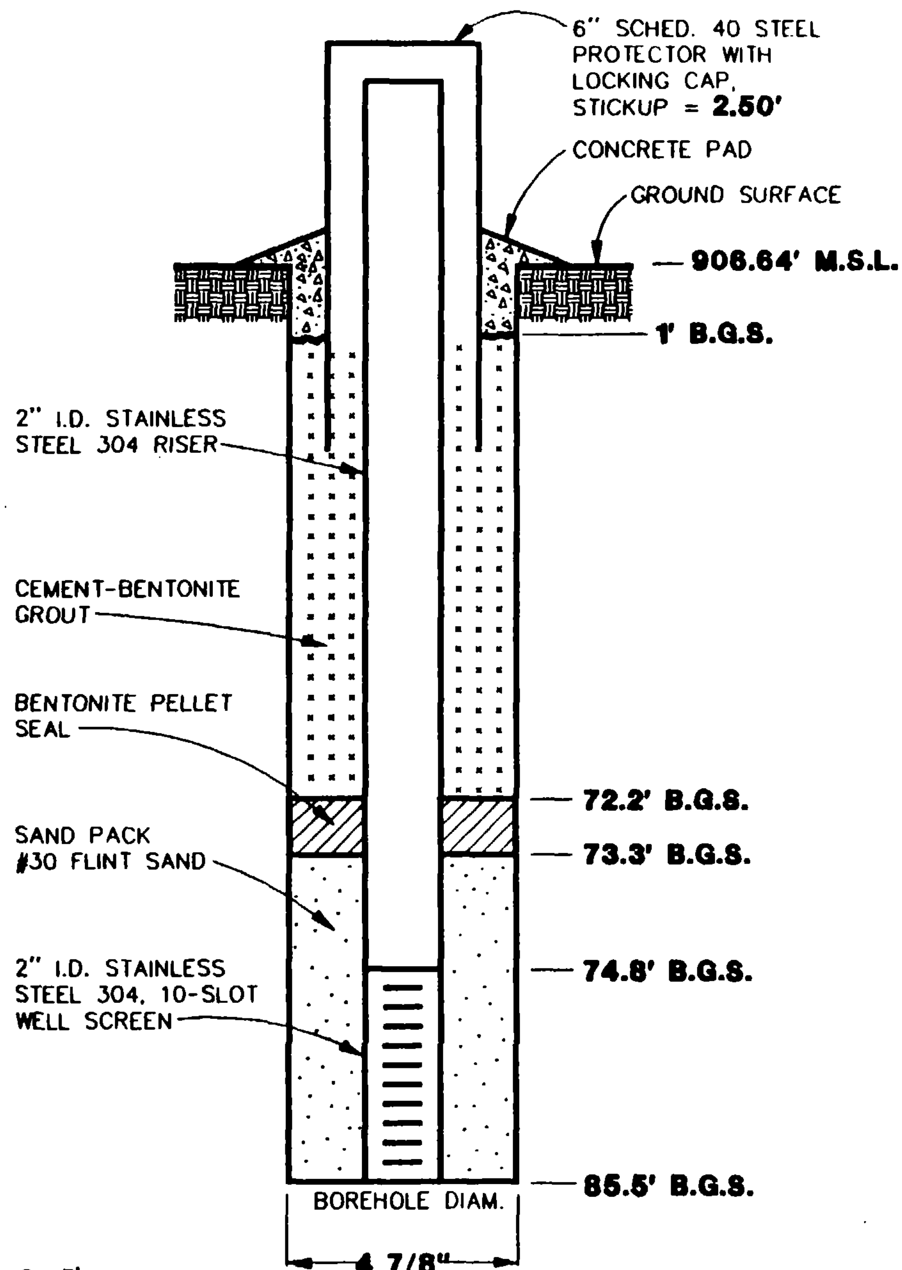
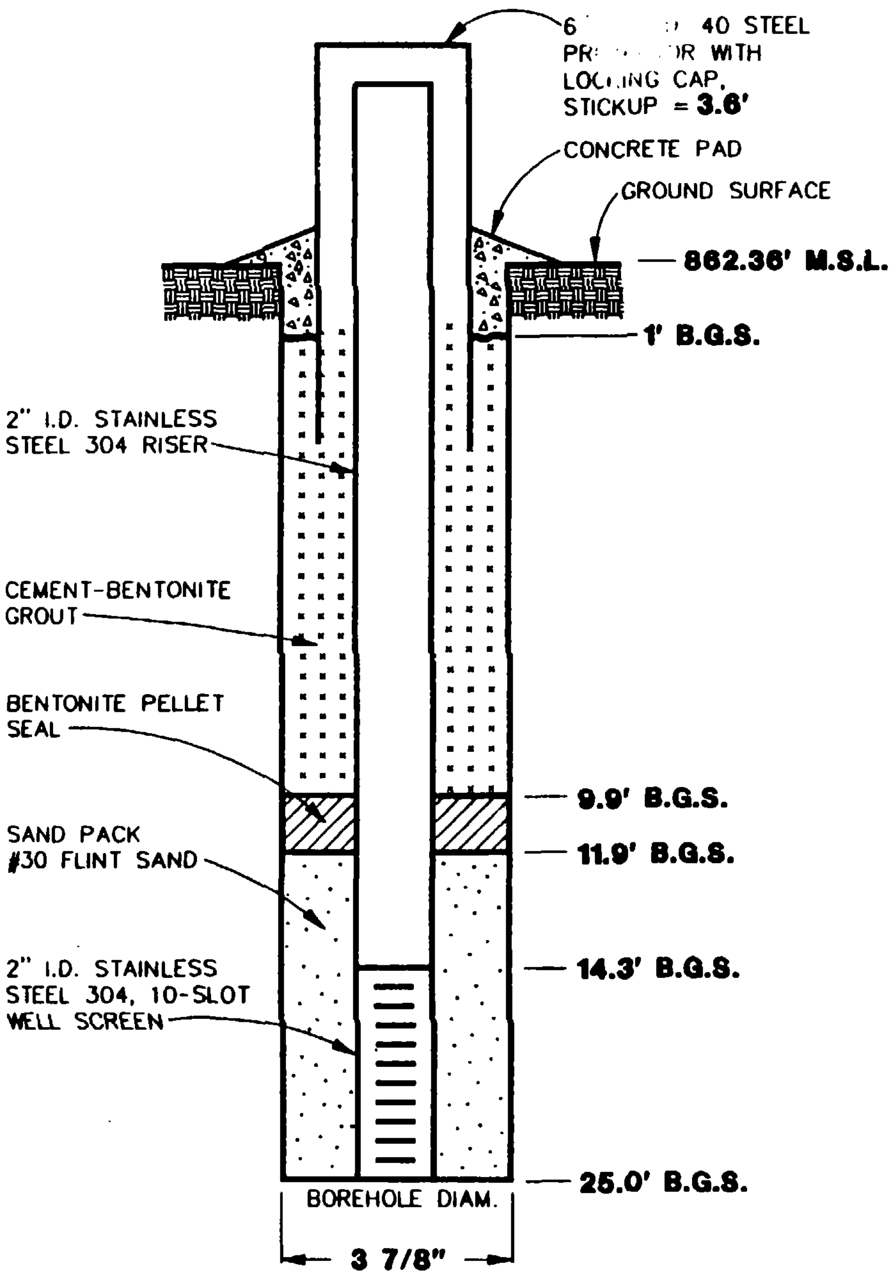


GW-87-16D

NOT TO SCALE

* Borehole Diam. = 4 1/2" from 0-17' and 3 7/8" from 17-24.7'.

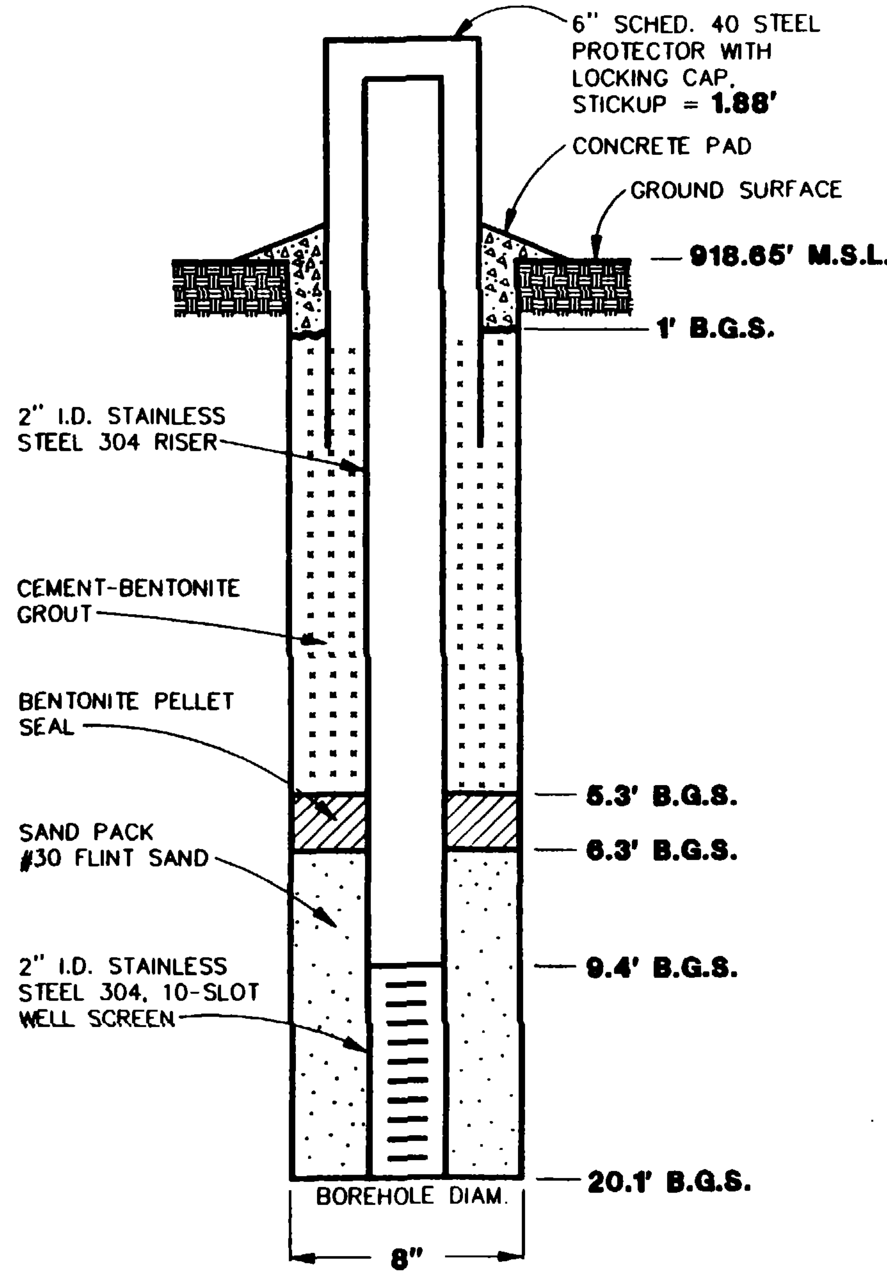
B.G.S. = BELOW GROUND SURFACE



GW-87-17D

NOT TO SCALE

B.G.S. = BELOW GROUND SURFACE



GW-87-18

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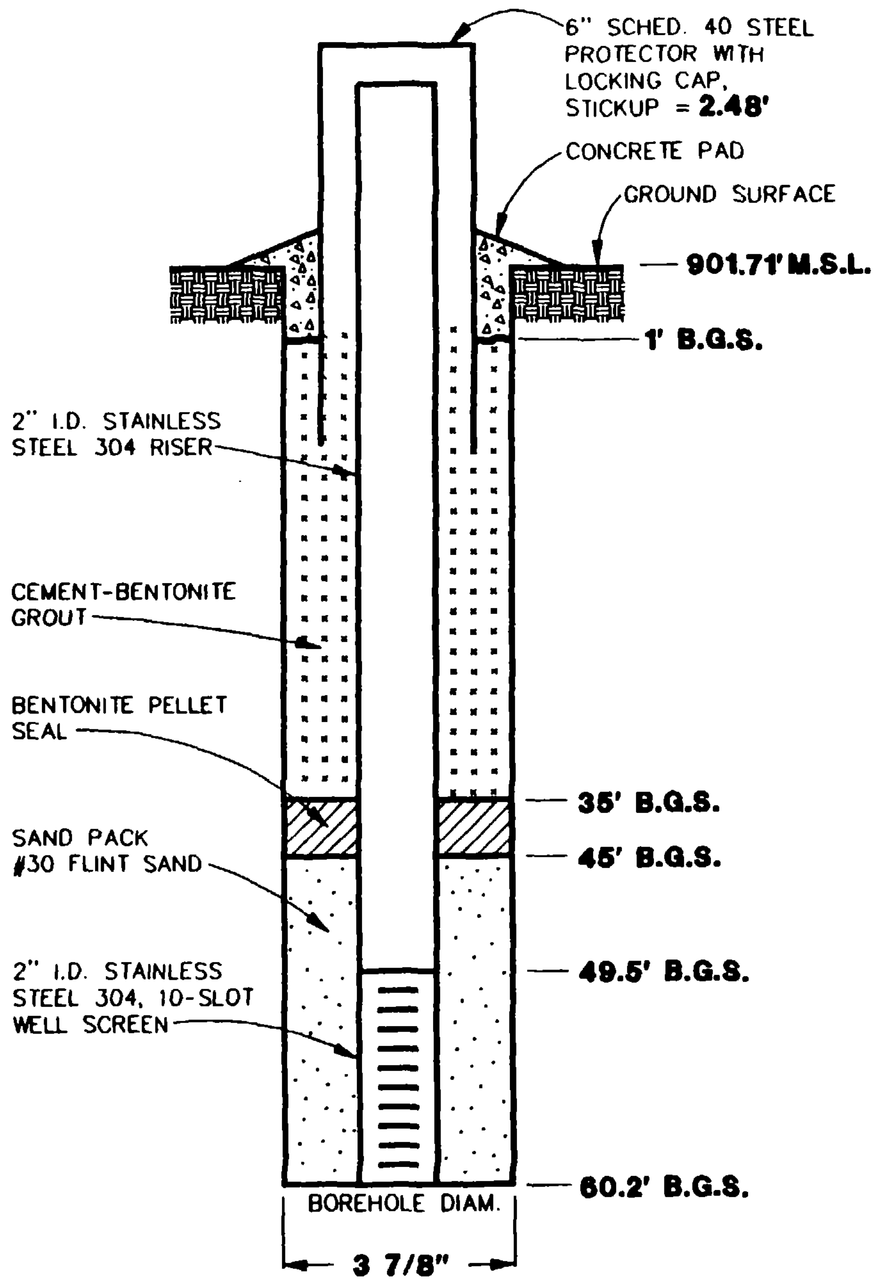

GW-87-19D

NOT TO SCALE

B.G.S. = BELOW GROUND SURFACE

Fieldwork Memorandum B-5
AQUIFER TESTING

CH2M HILL

FIELDWORK MEMORANDUM NO. B-5

TO: Donna Twickler, U.S. EPA, Remedial Project Manager

FROM: Randy Videkovich, CH2M HILL, Site Manager

PREPARED BY: Kevin Olson, CH2M HILL

DATE: March 8, 1988

RE: Phase II RI Aquifer Testing
Laskin Poplar Oil Site
EPA WA 132-5N03

PROJECT: W68792.FI

INTRODUCTION

Aquifer tests were conducted at the Laskin Poplar Oil site between December 1987 and February 1988. Hydraulic conductivities of the soil and sediment around the groundwater monitoring wells were measured using hydraulic pressure (packer) tests and variable head (slug) tests. This memorandum describes the test methods, data evaluation procedures, test results, and hydraulic conductivity data limitations.

HYDRAULIC PRESSURE TESTING

Packer tests are used to estimate hydraulic conductivity by measuring the rate at which rock units will accept water under known hydraulic head conditions. Discrete sections of the rock unit are isolated and tested with the use of inflatable "packers." The packer tests performed at Laskin Poplar Oil were the pumping-in type performed according to U.S. Bureau of Reclamation designation E-18.

At the Laskin Poplar site, packer tests were conducted on monitoring well boreholes that penetrate the shale unit underlying the site below a depth of 20 to 30 feet. Exploration Technology, Inc. of Madison, Wisconsin, conducted the tests, which were observed by either Roger Huddleston or Kevin Olson of CH2M HILL or Glen Anderson of Engineers International. Packer tests were performed at approximate 10-foot intervals within each deep borehole from the top of the unweathered shale to the bottom of the borehole. The lithologic contact between the weathered and unweathered shale (the depth at which packer testing began) was taken to be the depth of auger refusal.

APPARATUS

Figure B-5-1 shows a schematic diagram of the assembly that was used to perform the packer tests. Water was supplied from the City of Jefferson by a fire hydrant two blocks south of the site. Water was transported to the site by the subcontractor (Exploration Technology, Inc.) by the tank on either the drill rig or the tank truck. The mud pump on the drill rig was used to pressurize the system. The piping assembly associated with the test apparatus consisted of a surge suppressor, bypass valve, dual flowmeters, and a pressure gauge. The surge suppressor damped pressure surges from the positive displacement mud pump. The bypass valve was used to maintain a constant pump discharge pressure. Two flowmeters were provided in case one failed. During the test one meter was required while the other remained isolated. Discharge from the flowmeter was routed to the packer assembly through hollow drill rods. High pressure rubber hose was used for connector piping between each of the major components of the system. The packers were inflated with nitrogen, which was supplied through plastic tubing from a cylinder on the surface.

PROCEDURE

Three tests were performed at each depth interval. Each test was performed at different test pressures. The test was conducted by assembling the piping system as shown in Figure B-5-1 and starting the pump. The desired pump discharge pressure was attained by adjusting the bypass valve. After checking the packers and piping systems for leaks and when pump discharge pressure stabilized, the test was started. Discharge volume was measured at 1.0-minute intervals for 5 to 10 minutes while maintaining a constant pump discharge pressure. At the completion of each run, the discharge pressure was changed and the test repeated until at least three tests were completed at each interval.

DATA EVALUATION

The following method of analysis is described in detail by Cedergren (p. 64). By assuming that flow patterns in the tested section are ellipsoidal, the equation used to estimate hydraulic conductivity, when L is greater than 10R, is:

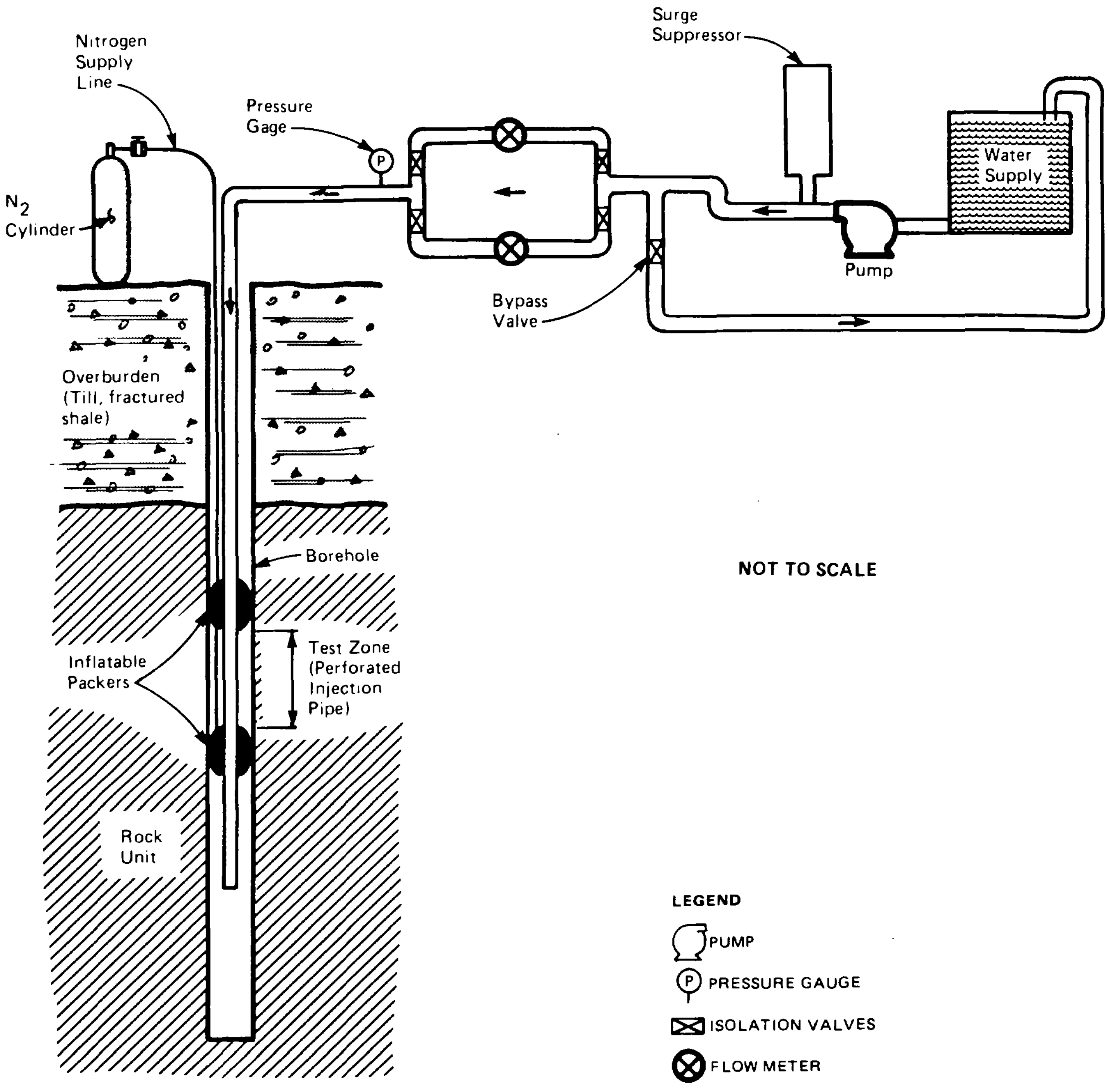

FIGURE B-5-1
SCHEMATIC DIAGRAM OF HYDRAULIC PRESSURE TESTING SYSTEM
LASKIN POPLAR TM

$$K = \frac{Q}{LH} \frac{1}{2\pi} \ln \left(\frac{L}{R}\right)$$

where,

K = hydraulic conductivity
Q = volumetric flowrate
L = length of the test section
H = total hydraulic head on the system
R = borehole radius

VARIABLE HEAD TESTING

Variable head (slug) tests are single well tests used to estimate hydraulic conductivity in the vicinity of a well screen by adding or removing a known volume of water. The rate at which the water level in the well recovers is measured and used to estimate the hydraulic conductivity.

The tests conducted at the Laskin Poplar site were "rising" head tests. A known volume of water was displaced from the well to lower the water level. Data were collected while water levels rose during well recovery. Tests were performed by Dan Plomb and Kevin Olson of CH2M HILL.

Two methods were used to remove water from wells. The preferred method, using a nitrogen slug, consisted of displacing water from the well with nitrogen gas. The method is preferred because contact between potentially contaminated well water and test equipment and personnel is minimized. In addition to health and safety concerns, the method reduces the possibility of cross-contamination of well water when test equipment is moved between several different wells. Use of the nitrogen slug method is limited to wells in which a sufficient volume of water can be displaced from the riser piping without lowering the water level below the top of the well screen. Because nitrogen gas would leak through the screen, it is not physically possible to use this method when the water level goes below the top of the well screen. The alternate method, using a PVC slug to displace well water, was used when the screened interval was close to or straddled the water table.

Two methods of analyzing the test data were used. Tests performed with the nitrogen slug were evaluated using both Hvorslev's method (Cedergren, pp. 66-76; originally presented in U.S. Department of the Army, Corps of Engineers, 1951) and the Bouwer-Rice method. Because Hvorslev's method does not account for water rising in the screened interval, the PVC slug tests were evaluated using only the Bouwer-Rice method, which contains a correction factor to adjust the borehole radius to account for the sand pack when the water level is changing within the borehole.

NITROGEN SLUG METHOD

The test assembly used to displace well water using nitrogen gas is shown in Figure B-5-2. A well head assembly was attached to the top of the riser pipe. A gastight seal between the assembly and riser pipe was obtained with an expandable rubber fitting at the base of the assembly. The well head assembly contains gastight ports for connecting two pressure transducers, a fitting for attaching a pressure regulator, and a vent valve.

The pressure transducers are connected to a data logger. Transducer No. 1 measures total head, which is the sum of the elevation head and pressure head above the transducer. Transducer No. 2 measures the pressure head resulting from the nitrogen gas. In addition to recording head values at discrete time intervals for later analysis, the data logger is programmed to calculate hydraulic conductivity directly in the field using simplifying assumptions regarding aquifer geometry. Therefore, a quick field check on the validity of the data is possible prior to disassembling the equipment.

After the initial water level is noted (prior to pressurizing the system), a column of nitrogen is placed in the riser pipe. Because the units of the data logger readout are in feet of water, the equivalent water height due to the nitrogen pressure head is read directly from transducer No. 2. The amount of pressure head placed in the well is such that water will be displaced at least 2 to 3 feet, but not below the top of the screen. Pressure is controlled by regulators in the nitrogen supply line. The pressure head forces water from the riser casing through the well screen and into the surrounding sediments. As the water level in the well decreases under a constant pressure head, the total head (transducer No. 1) decreases. Eventually, total head will return to the initial head value (initial water level), except that now the total head above transducer No. 1 includes the pressure com-

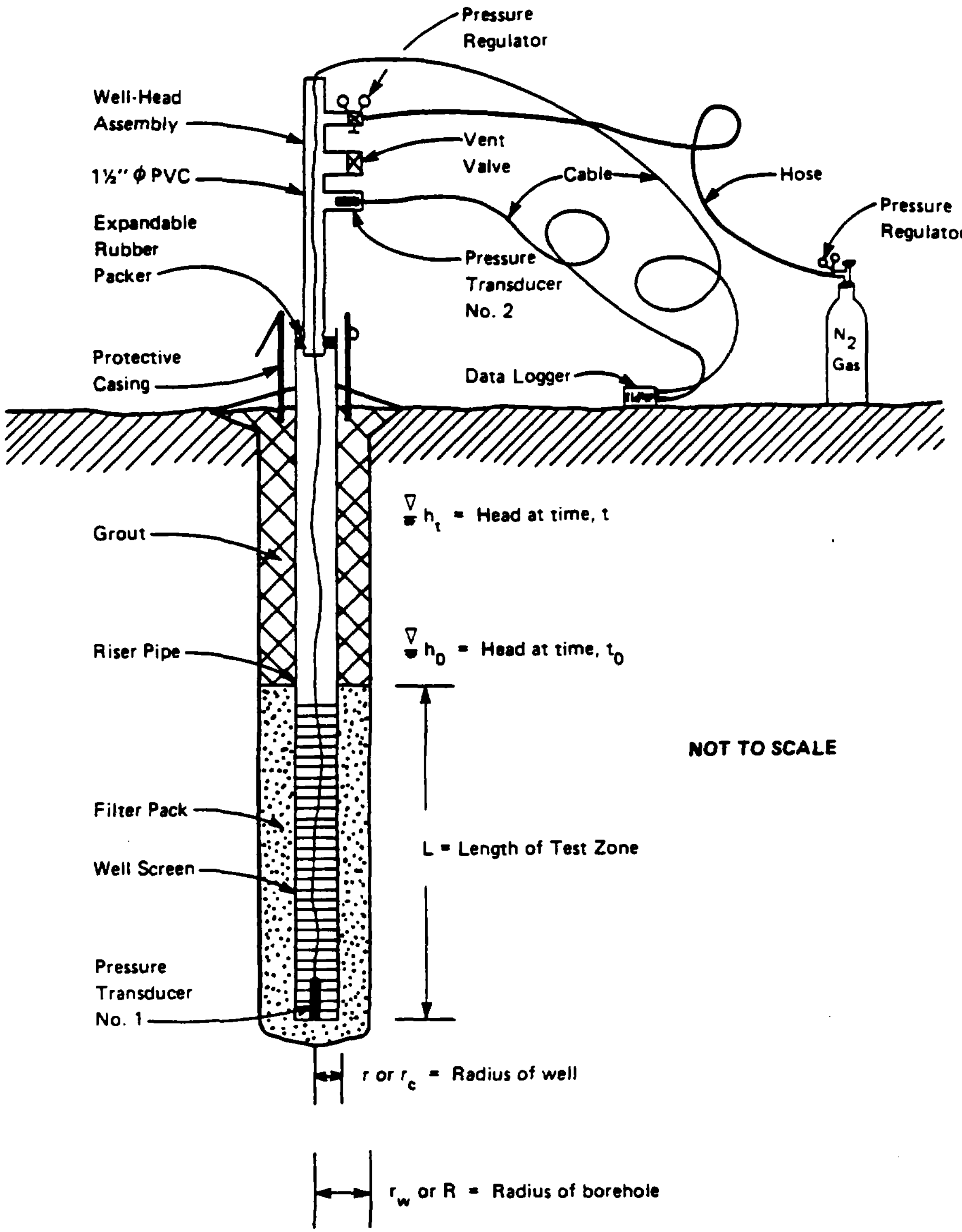

FIGURE B-5-2
SCHEMATIC DIAGRAM OF NITROGEN SLUG TEST ASSEMBLY
LASKIN POPLAR OIL

ponent from the nitrogen gas. At this point the test is started by opening the vent valve to remove the pressure head by depressurizing the system, and by starting the data logger. In effect, th is equivalent to instantaneously removing a column of wa equal to the volume of water displaced by the gas. W r levels are then recorded with time as they recover.

PVC SLUG METHOD

In theory, the PVC slug method is identical to the nitrogen slug method, except that a PVC slug rather than nitrogen gas is inserted in the well to displace the water. The PVC slug is hollow, allowing the use of a pressure transducer for measuring and recording water levels. The slug and test apparatus for this method are shown on Figure B-5-3.

DATA EVALUATION

Hvorslev's Method

A complete discussion of the method and definition of terms is presented in Cedergren. The equation used to calculate hydraulic conductivity is:

$$K = \frac{r^2 \ln \left(\frac{L}{R}\right)}{2LT_o}$$

where,

- K = hydraulic conductivity
- r = well radius
- R = borehole radius
- L = screen length
- T_o = basic time lag, determined graphically as the time at which relative recovery is equal to 0.37

Bouwer-Rice Method

The equation for estimating hydraulic conductivity using the Bouwer-Rice method is:

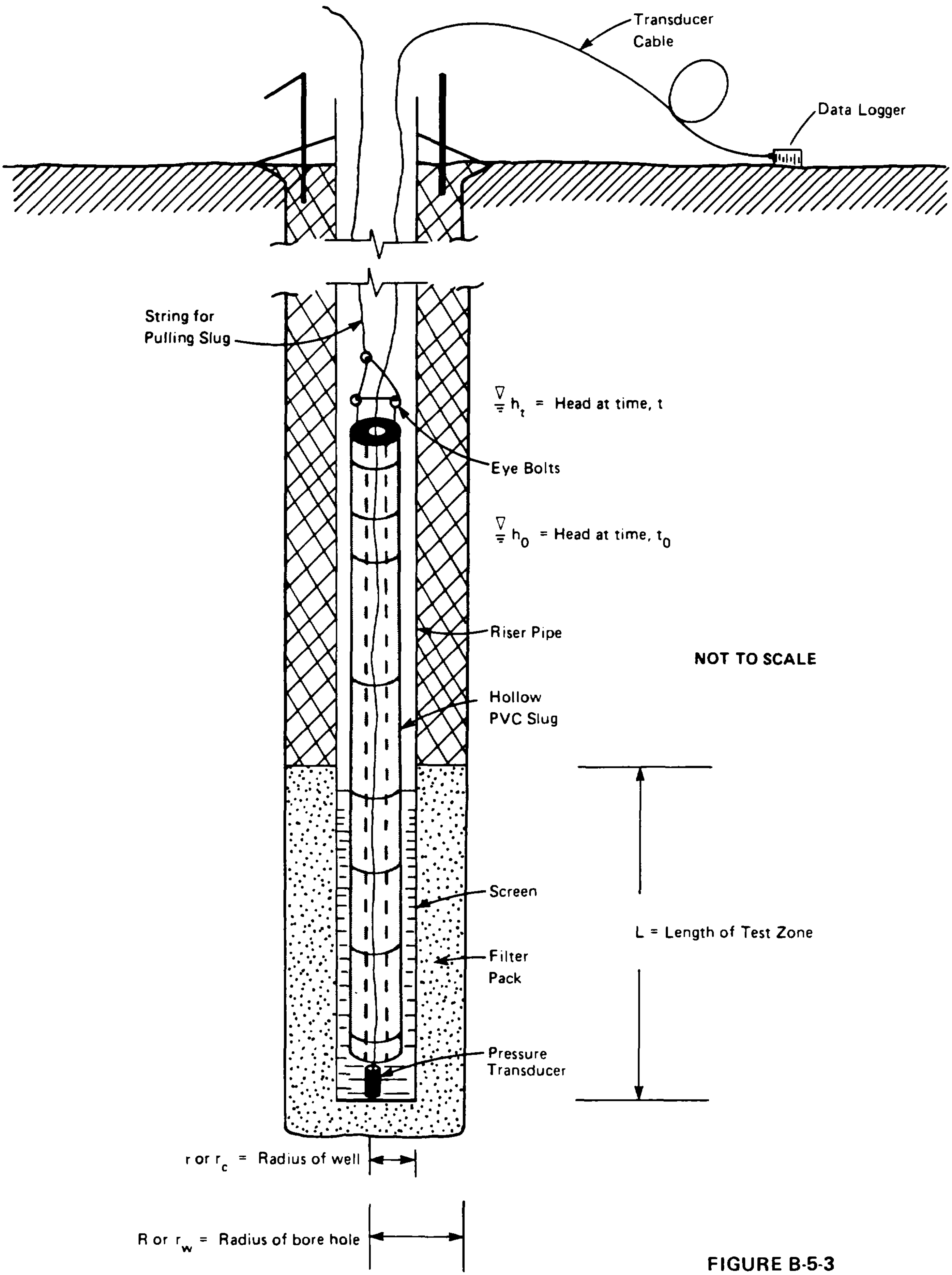

FIGURE B-5-3
PVC SLUG TEST ASSEMBLY
LASKIN POPLAR OIL

$$K = \frac{r_c^2 \ln\left(\frac{R_e}{r_w}\right)}{2L} \frac{1}{t} \ln \frac{Yo}{Y}$$

where,

K = hydraulic conductivity

L = length of test zone

t = time measured from start of test

Y_o = initial head difference

Y_t = head difference at time, t

r_c = well radius, corrected for porosity in the sand pack

$\ln (R_e/r_w)$ = natural log of the ratio between the effective radius over which head loss is dissipated in the flow system and the radius of the borehole. The value of this term is determined graphically using several curves for empirical constants given by Bouwer and Rice (p. 426).

RESULTS

Test results are summarized in Tables B-5-1, B-5-2 and B-5-3. Raw data and data reduction notes are included in the project files.

DATA LIMITATIONS

Packer Tests

The hydraulic conductivity for well GW87-14D differs by at least two orders of magnitude, depending on the method of determination. No measurable flow was observed during the packer test, indicating a conductivity of less than 1×10^{-5} cm/s. However, a slug test in the well indicates a hydraulic conductivity of 2×10^{-3} cm/s. Two possible explanations of this discrepancy are: 1) fracture zones were isolated during the packer test, which had a slightly smaller test interval than the slug test; or 2) fracture zones and pore spaces were clogged during the packer test from smearing of silty, clayey mud on the borehole wall during the drilling

Table B-5-1
HYDRAULIC CONDUCTIVITY OF EXISTING WELLS

Well Number	Geologic Unit/ Soil Description	Previous Work (cm/s)[a]	Hvorslev (cm/s)
GW001	Weathered Shale	4×10^{-4}	1×10^{-5}
GW002	Weathered Shale	8×10^{-4}	9×10^{-5}
GW004	Weathered Shale	9×10^{-4}	1×10^{-3}
GW005	Shale	5×10^{-4}	3×10^{-4}
GW006	Weathered Shale	3×10^{-3}	2×10^{-3}
GW007	Shale	2×10^{-3}	9×10^{-3}
GW008	Weathered Shale	4×10^{-4}	3×10^{-4}
GW009	Weathered Shale	(b)	(c)
GW010	Shale	2×10^{-4}	(d)
GW011	Shale	9×10^{-4}	2×10^{-3}
B-1	Shale	9×10^{-4}	(d)

[a]Computed using Bouwer-Rice method (data from CDM Federal Programs Corporation, 1987)
[b]No data available
[c]Unable to interpret test results
[d]Not tested

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Table B-5-2
HYDRAULIC CONDUCTIVITIES IN NEW,
SHALLOW WELLS

Well Number	Geologic Unit/ Soil Description	Slug Tests Hvorslev (cm/s)	Slug Tests Bouwer-Rice (cm/s)
GW87-03	Interbedded shale, weathered shale	(a)	(a)
GW87-05	Fill material above weathered shale	(a)	(a)
GW87-06	Silty clayey fill(?) above weathered shale	(a)	(a)
GW87-07	Silty clay above weathered shale	2×10^{-5}	2×10^{-5}
GW87-08	Till and weathered shale	(a)	(a)
GW87-09	Till and weathered shale	2×10^{-4}	2×10^{-4}
GW87-11	Till and weathered shale	(a)	(a)
GW87-18	Till and weathered shale	3×10^{-5}	2×10^{-5}

[a] Unable to interpret results. Over 70 percent of the recovery occurred during the first 20 seconds of the site tests. Desaturation and drainage of the sand pack in the well during that period made it impossible to separate the aquifer properties from the sand-pack properties during the test.

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Table B-5-3
HYDRAULIC CONDUCTIVITIES FOR
THE SHALE UNIT

Well Number	Lithologic Description	Packer Tests: Test Interval (ft bgs)	Packer Tests: K (cm/s)	Slug Tests: Hvorslev (cm/s)	Slug Tests: Bouwer-Rice (cm/s)
GW87-01D	Grey shale	48.9-60.4	(a)	(b)	(b)
	Grey shale	40-52.5	(a)		
	Grey shale	30-42.5	(a)		
GW87-06D	Grey shale	60-70	(a)	(b)	(b)
GW87-11D	Grey shale	23.5-34.8	1×10^{-5}	(b)	(b)
GW87-14D	Grey shale	13.3-24.8	(a)	2×10^{-3}	2×10^{-3}
GW87-15D	Grey shale		(b)	3×10^{-4}	2×10^{-4}
GW87-16D	Grey shale with interbedded hard and soft layers	25.5-37.9	(a)	(b)	(b)
		36.6-49.0	(a)		
		44.8-57.2	(a)		
		55-67.4	(a)		
		65-77.4	9×10^{-6}		
		75-85.5	1×10^{-3}		
GW87-17D	Grey shale, fissile	13.8-25.2	9×10^{-4}	3×10^{-3}	2×10^{-3}

[a]No measurable flow observed
[b]Not tested

process. The slug test zone was approximately 1 foot longer than the packer test zone. In addition, the slug test was performed after well development, which should open fracture and pore spaces by removing silt and clay particles from the well.

Borehole smearing could be significant. Each of the deep boreholes was drilled with a roller bit with a water wash. Since this is a shale interbedded with softer clay beds, the water wash may have mixed with the clay forming a mud that could easily penetrate and clog the pore spaces on the borehole wall.

Slug Tests

The following assumptions are inherent in the theoretical development of both Hvorslev's and the Bouwer-Rice equations for analyzing slug test data:

- Drawdown of the water table around the well is negligible
- Flow in the unsaturated zone can be ignored
- Well losses are negligible
- The aquifer is homogeneous and isotropic

The first three assumptions are probably satisfied at the Laskin Poplar site. The surface aquifer, however, is neither homogeneous nor isotropic. The screened portion of most of the wells analyzed receive water from the lower part of the glacial till unit and the top of the shale, which is typically weathered and somewhat fractured. In addition, shales are characteristically anisotropic, with horizontal hydraulic conductivities being significantly higher than vertical conductivities. Although the last assumption is not satisfied at the Laskin Poplar site, the data and conductivity values are still useful as estimates of hydraulic conductivity and for comparison of spatial variability between the wells tested onsite.

Packer tests and slug tests do not necessarily show the actual extent of variability of hydraulic conductivities that could exist at the site. Results from single well aquifer tests are strictly applicable only in the immediate vicinity of the screened portion of the tested well. The data obtained at the Laskin Poplar Oil site should, generally, be transferrable to other geologically similar parts of the site. However, the variability within extensive fill deposits on the site and in weathered zones is significant according to the soil boring logs. Hydraulic conductivities in these areas may be different than in tested areas.

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Fieldwork Memorandum B-6
BATHYMETRIC SURVEY

GLT777/48-6

FIELDWORK MEMORANDUM B-6

TO: Donna Twickler, U.S. EPA Remedial Project Manager

FROM: Randy Videkovich, CH2M HILL Site Manager

PREPARED BY: Bob Weinschrott, CH2M HILL Sample Team Leader

DATE: February 4, 1988

RE: Phase II RI Bathymetric Survey
Laskin Poplar Oil Site
EPA WA 132-5N03

PROJECT: W68792.FW

OBJECTIVES

The Phase II RI Work Plan evaluation of existing data identified several data gaps concerning the freshwater and retention ponds. Limited data were available on water quality in the ponds and the representativeness of the existing data relative to the entire ponds is unknown. Further, since it was unknown if the ponds are hydraulically connected with the surficial aquifer, the hydrogeologic interpretation of the site remained incomplete. Bathymetric surveys of the ponds were proposed for:

- o Defining the bottom geometry of the ponds to select sediment and surface water sampling locations
- o Defining the depth of the ponds to evaluate whether or not the ponds are in contact with the shale, the shallow aquifer

The bathymetric surveys would aid in the Feasibility Study by defining the volume of water that would be affected by remedial alternatives at the site.

METHODOLOGY

The bathymetric surveys evaluated the bottom geometry of the ponds by sounding the ponds on a defined grid. The surveys were limited to measuring the depth from the water surface to the bottom of the pond, with the bottom of the pond defined as the point at which a weighted line stopped sinking. This methodology does not assess the nature of the bottom of the pond (i.e., the depth of sediments).

The bathymetric survey team consisted of:

- o Bob Weinschrott, CH2M HILL, SSO/Level C and D
- o Glen Anderson, Engineers International, Inc.
- o Scott Brockway, Engineers International, Inc.

Donna Twickler, U.S. EPA, also assisted during the freshwater pond bathymetric survey.

The survey was performed using a flat-bottomed, aluminum boat and a weighted line calibrated in 0.1-foot increments. A rectangular grid was developed from an east-west base line along the edge of each pond with the easiest and safest access; the south edge of the freshwater pond and the north edge of the retention pond. The grid lines on the freshwater pond were at 20-foot intervals north-south and east-west. The retention pond grid was on 10 feet north-south and 10 or 20 feet east-west. For each pond, the north-south transect was established and, using a rope marked off in either 10- or 20-foot increments stretched across the pond, the water depth was measured at each marked location. Near the shore and in areas where the depth varied rapidly, depths were measured more frequently.

The water surface elevation of both ponds was determined relative to the top of casing of existing Well GW001.

SITE SAFETY CONCERNS

Work on the freshwater pond was performed in Level D protection. Both people in the boat wore U.S. Coast Guard approved life vests and the person measuring the depths also had a safety line attached around his waist. The Level D SSO was onshore with a life ring.

Level C protection was used at all times on the retention pond for the people in the boat and the SSO. Continuous monitoring with a Foxboro 128GC organic vapor analyzer (OVA) and an explosimeter/oxygen meter was maintained at all times in the boat. At no time did the OVA vary from background and no low oxygen or explosive conditions were observed. Boat safety procedures were the same in both ponds.

RESULTS

The results of the bathymetric survey are presented as both contour maps and cross sections illustrating the bottom geometry of both ponds (Figures B-6-1 and B-6-2.) The contour maps also show the depth data from the survey and the grid used in the survey.

FRESHWATER POND

The freshwater pond was surveyed on November 18, 1987. The depth of the pond drops off quickly to 4 to 6 feet at its southern end and to 8 to 10 feet on the northern end (Figure B-6-1). The northeast quarter of the pond is the deepest, with depths of 8 to 12 to 16 feet. A mound of earth at the center of the pond rises to 2 feet above the water surface. In general, however, the pond slopes down to the north and rises steeply at the north dike as shown in the cross sections on Figure B-6-1.

Mr. Laskin, owner of the property, told Weinschrott that the freshwater pond, which was used as a storage basin for water for the Laskin greenhouses, was constructed by pushing soil from the pond to the sides for the surrounding dike. The soil varied from a stiff brown to a very stiff gray clay. The pond is fed by two drain pipes, one coming from an nearby irrigation ditch and another that drains from the fairgrounds immediately across from the road south of the freshwater pond.

RETENTION POND

The retention pond was surveyed on November 19, 1987. The pond had a maximum depth of approximately 6 feet at the time of the survey. The bottom is fairly flat throughout the pond, as shown in Figure B-6-2. The depth of the pond can vary by several feet because it is the collection basin for most runoff water from the Laskin property. Figure B-6-2 also shows a cross section from the middle of the pond.

Mr. Laskin stated that the retention pond was constructed by pushing soil from the pond to the dikes, similar to the freshwater pond. However, most of the dike material is fill brought in from offsite. The pond is fed by a ditch running along the toe of the slope below the pits, by a drain coming from around the greenhouses, and by a drain from the Laskin residence and the Laskin workshops. (A drain was observed in the boiler house near Boiler No. 3. Mr. Laskin stated that it, too, drained to the retention pond.)

Mr. Laskin also stated that a tile system buried in the open area north of the greenhouses drains eventually to the retention pond. During November and December, the water level of the pond varied by approximately 2 feet as snowmelt and rain collected in the pond. The pond outlet is several buried pipes that drain into the treatment ponds at the toe of the slope north of the site near old Poplar Street.

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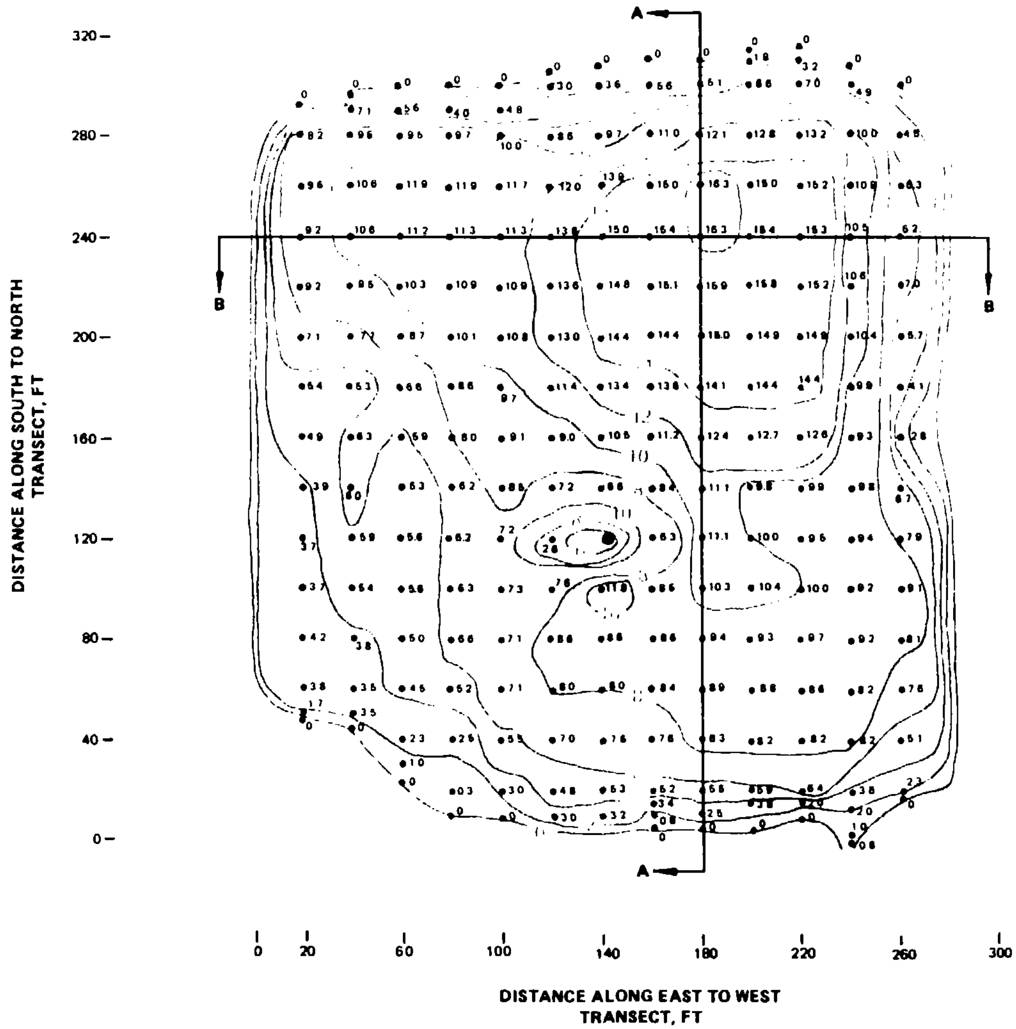


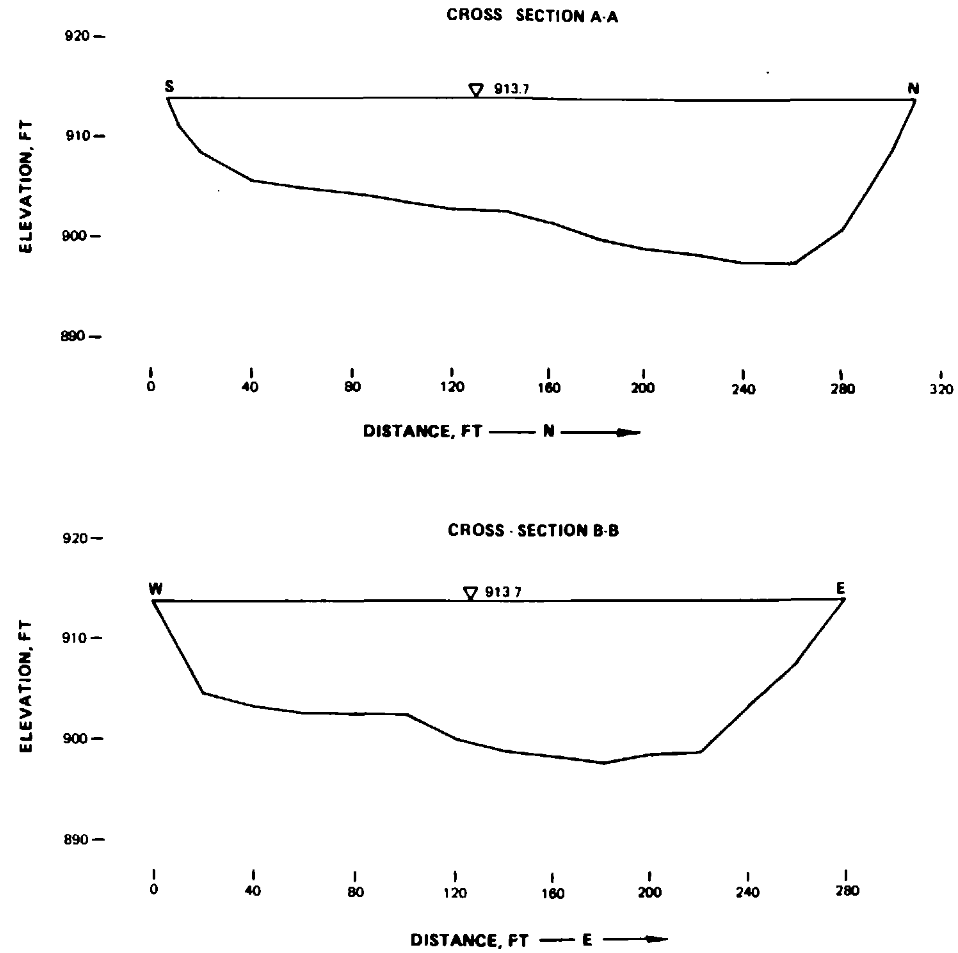
CONTOUR INTERVAL = 1 FT

WATER SURFACE ELEVATION = 913.7 FT (DATUM = GW001 TOP OF CASING)

NOTES

NUMBERS ON FIGURE INDICATE DEPTH BELOW WATER SURFACE IN FEET

LINES A-A AND B-B DENOTE THE CROSS SECTIONS SHOWN



4 TO 1 VERTICAL EXAGGERATION (DATUM = GW001 TOP OF CASING)

FIGURE B-6-1
BATHYMETRIC MAP AND
CROSS SECTIONS
OF THE FRESHWATER PO
LASKIN POPLAR

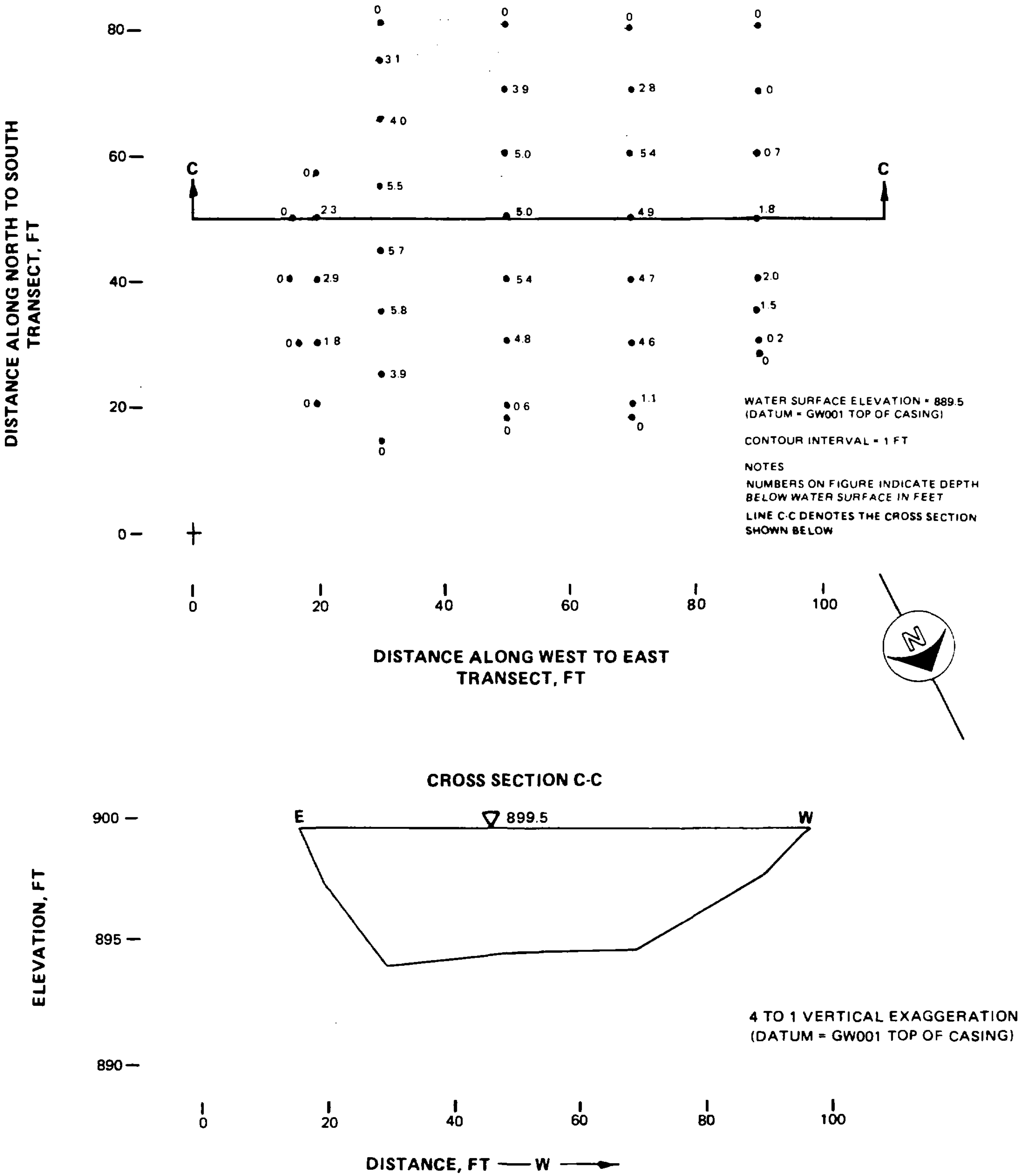


FIGURE B-6-2
BATHYMETRIC MAP AND CROSS SECTIONS OF THE RETENTION POND
LASKIN POPLAR

Fieldwork Memorandum B-7
SURFACE WATER SAMPLING

CH2M HILL

FIELDWORK MEMORANDUM B-7

TO: Donna Twickler, U.S. EPA Remedial Project Manager

FROM: Randy Videkovich, CH2M HILL Site Manager

PREPARED BY: Bob Weinschrott, CH2M HILL Sample Team Leader

DATE: February 4, 1988

RE: Phase II RI Surface Water Sampling
Laskin Poplar Oil Site
EPA WA 132-5N03

PROJECT: W68792.FW

OBJECTIVES

Surface water sampling was performed at the Laskin Poplar Oil site on December 9 and 10, 1987. The evaluation of existing data for the Phase II RI Work Plan had identified several data gaps concerning surface water quality in the freshwater and retention ponds. The work plan proposed collecting additional surface water samples:

- To refine water quality interpretations for use in the baseline risk assessment

- To refine water quality issues affecting alternative development for the Feasibility Study

The work plan proposed collecting additional surface water samples at three locations in the freshwater pond and two in the retention pond. Two samples were to be collected per location to identify water quality changes due to thermal stratification. During the first period of the Phase II RI fieldwork, two seeps from the site were identified and a work plan revision request was submitted proposing collection of a water sample at each of those locations.

METHODOLOGY

Surface water sampling locations identified in the bathymetric survey and by site reconnaissance are shown in Figure B-7-1. Except for location SW87-01 in the freshwater pond, only one sample was collected at each location in the ponds. Cold weather and shallow water in the other locations eliminated thermal stratification and the need to collect samples at two depths. At these locations, a composite sample was collected with a 4-foot bailer. Table B-7-1 reports the samples collected at each location and the rationale for collecting them.

Table B-7-2 presents the types of analyses for each collected sample. The sample collection date, sample identifiers, and the laboratory the sample was shipped to are also shown on the table. The field parameter results are presented in Table B-7-3.

The surface water sampling team consisted of:

- Randy Videkovich, CH2M HILL, SSO/Level C and D
- Kevin Olson, CH2M HILL
- Angelo Liberatore, CH2M HILL
- Alan Esko, Engineers International, Inc.

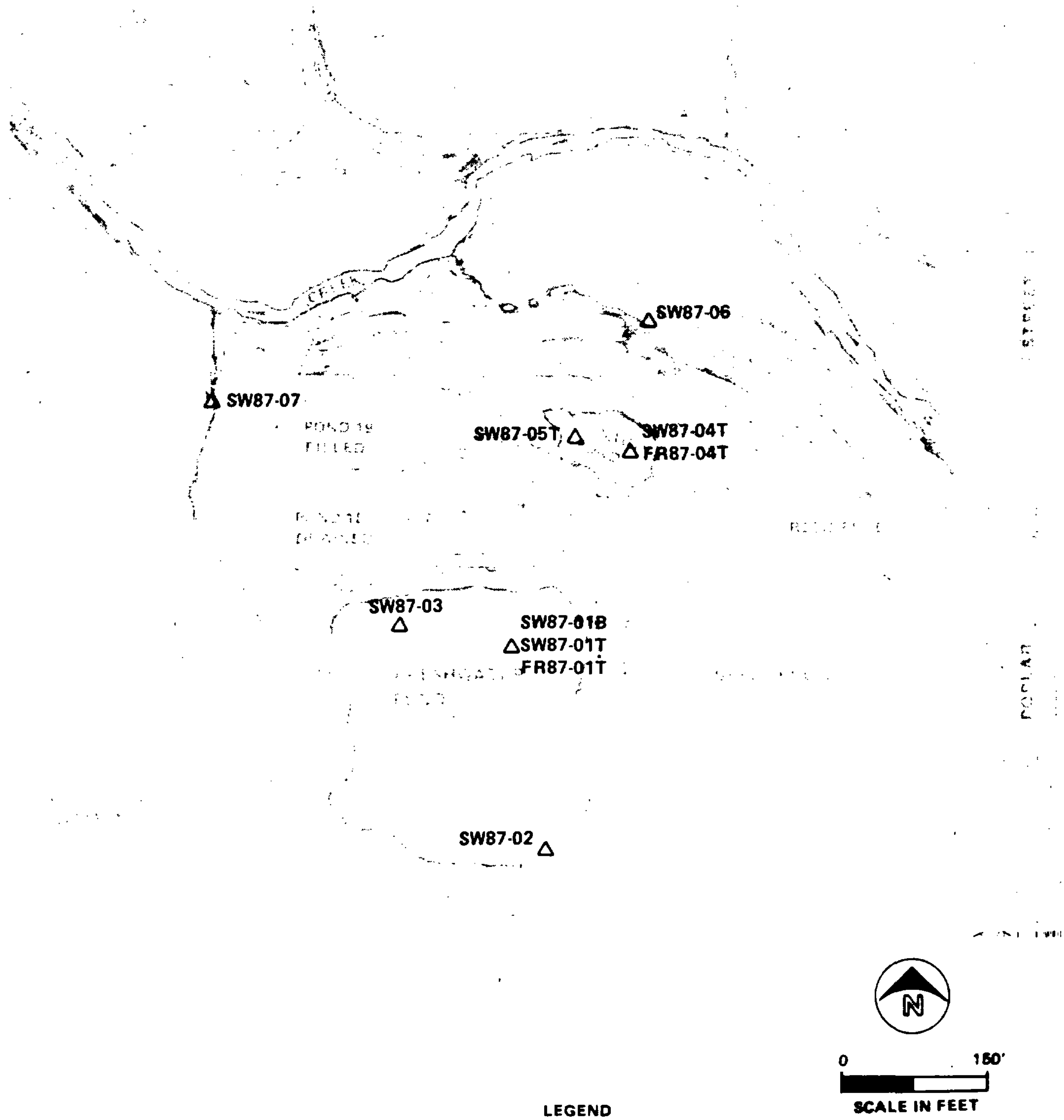
All pond samples were collected from a boat. At location SW87-01, a Kemmerer bottle was used to collect samples at both the top and bottom of the water column. The bottom sample (SW87-01-B) was collected at a depth of approximately 12 feet. The upper sample (SW87-01-T) was collected in the 0- to 4-foot depth interval. At all other pond locations, a stainless steel bailer was used to collect a composite sample in the 0- to 4-foot depth interval or from the surface to 6 inches above the bottom in shallow locations. At both seep sampling locations, samples were collected directly from the seeps.

Replicates were collected at locations SW87-01-T and SW87-04. The surface water blank was collected by pouring HPLC grade water directly into the sample bottles. This method was used since several samples were collected by pouring the water directly into the bottle.

Sampling equipment was decontaminated between locations with a trisodium phosphate solution, a water rinse, a methanol water rinse (approximately 10 percent methanol in distilled water), followed by a triple rinse with distilled water.

SITE SAFETY CONCERNS

Work on the freshwater pond was performed in Level D protection. Both people in the boat also wore U.S. Coast Guard



LEGEND

△ PHASE II RI SURFACE WATER SAMPLE LOCATIONS

FIGURE B-7-1
SURFACE WATER SAMPLING LOCATIONS
LASKIN POPLAR

Table B-7-1
SURFACE WATER SAMPLING LOCATIONS, SAMPLE NUMBERS,
AND RATIONALE FOR SAMPLE COLLECTION

Location	Samples	Rationale
Freshwater Pond 1	SW87-01-T FR87-01-T SW87-01-8	Deepest area of pond, most likely to accumulate contaminants. Two depths selected to evaluate effect of thermal stratification.
Freshwater Pond 2	SW87-02	Inlet to pond from irrigation ditch and drainage from the fairgrounds. Establish water quality near the inlet and water quality on south end of pond.
Freshwater Pond 3	SW87-03	Establish water quality in pond nearest to contaminant source in water shallower than at Location 1.
Retention Pond 1	SW87-04 FR87-04	East part of pond, near inlets of drains from the greenhouse and other portions of the Laskin property.
Retention Pond 2	SW87-05	West part of the pond near the inlet fed by surface water runoff from within the exclusion zone.
Seep 1	SW87-06	Seep in toe of slope just north of retention pond Mr. Laskin stated that this seep is from a a buried pipe draining from the retention pond.
Seep 2	SW87-07	Seep in ravine west of site near Cemetery Creek, assumed to be a discharge boundary for surficial aquifer.

Note: Samples beginning with "FR" are replicates. For example, the replicate for sample SW87-01-T is FR87-01-T.

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Table B-7-2

SAMPLE MATRIX FOR SURFACE WATER SAMPLES
PHASE II RI

						RAS ANALYSES					SAS ANALYSES AND LABS								
							METALS (2)		CYANIDE			LOWER DETECTION LIMITS							
LOCATION	SAMPLE NUMBER	SAMPLE DATE	CRL NUMBER	CASE NUMBER	OTR	ORGANIC LAB	ITR	LAB	ITR	LAB	SAS NUMBER	VOC's	PHENOL	MERCURY	BOD	COD, TOC	TDS, TSS	Alk, SO4, Cl	Oil & Grease
Freshwater Pond	LP-SW87-01-T	10-Dec-87	88HW01S95	8690	ES550	CENREF	MES339	Enseco	MES334	Enseco	3466E	148	148	CRL	148	148	148	148	148
"	LP-FR87-01-T	10-Dec-87	88HW01D95	"	ES551	"	MES340	"	MES335	"	"	149	149	"	149	149	149	149	149
"	LP-SW87-01-B	10-Dec-87	88HW01S57	"	ES502	"	MES330	"	MES549	"	"	145	145	"	145	145	145	145	145
"	LP-SW87-02	10-Dec-87	88HW01S94	"	ES549	"	MES338	"	MES333	"	"	150	150	"	150	150	150	150	150
"	LP-SW87-03	10-Dec-87	88HW01S92	"	ES547	"	MES336	"	MES331	"	"	147	147	"	147	147	147	147	147
Retention Pond	LP-SW87-04-T	09-Dec-87	88HW01S59	"	ES504	"	MES342	"	MEM551	"	"	NA (1)	NA	"	91	152	91	91	152
"	LP-FR87-04-T	09-Dec-87	88HW01D59	"	ES506	"	MES341	"	MEM455	"	"	NA	NA	"	92	151	92	92	151
"	LP-SW87-05-T	09-Dec-87	88HW01S60	"	ES505	"	MES343	"	MEM552	"	"	NA	NA	"	93	153	93	93	153
Seep 1	LP-SW87-06	10-Dec-87	88HW01S55	"	EQ238	"	MES328	"	MEM547	"	"	143	143	"	143	143	143	143	143
Seep 2	LP-SW87-07	10-Dec-87	88HW01S56	"	ES501	"	MES529	"	MEM548	"	"	144	144	"	144	144	144	144	144
Blank	LP-FB-03	10-Dec-87	88HW01S93	"	ES548	"	MES337	"	MES332	"	"	146	146	"	146	146	146	146	146

Notes:

1. NA = Not analyzed for this parameter
2. metals samples not filtered for surface water samples.

Table B-7-3
FIELD PARAMETERS FOR SURFACE WATER SAMPLES

Sample	pH	Specific Conductance[a] (umhos)
SW87-01-T	6.5	280
FR87-01-T	6.5	270
SW87-01-B	6.5	230
SW87-02	6.6	270
SW87-03	6.6	270
SW87-04	6.7	280
FR87-04	6.7	270
SW87-05	6.7	260
SW87-06	6.6	320
SW87-07	6.6	250
Blank (FB-03)	7.7	--

[a]Temperature $\cong$ 15° C.

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approved life vests and the person collecting the sample also had a safety line attached around his waist. The SSO was onshore with a life ring.

Level C protection was used at all times on the retention pond for the people in the boat and the SSO. Continuous monitoring with a Foxboro 128GC organic vapor analyzer (OVA) and an explosimeter/oxygen meter was maintained at all times in the boat. At no time were low oxygen or explosive conditions observed. OVA readings in the breathing zone during surface water sampling did not vary from background conditions. Boat safety procedures were the same in both ponds.

VISUAL OBSERVATIONS

At the time of sampling, the retention pond did not have a 1/2- to 3/4-inch oil layer on the surface as reported during the REM/FIT sampling effort (1983). Mr. Laskin discussed the retention pond with Bob Weinschrott/CH2M HILL Sample Team Leader and stated that at times the pond had had several feet of oil on the surface. However, most of the oil was removed in earlier remedial responses and the remaining layer has slowly dissipated.

GLT777/4

Fieldwork Memorandum B-8
SEDIMENT SAMPLING

CH2M HILL

FIELDWORK MEMORANDUM NO. B-8

TO: Donna Twickler, U.S. EPA Remedial Project Manager

FROM: Randy Videkovich, CH2M HILL Site Manager

PREPARED BY: Bob Weinschrott, CH2M HILL Sample Team Leader

DATE: February 4, 1988

RE: Phase II RI Sediment Sampling
Laskin Poplar Oil Site
EPA WA 132-5N03

PROJECT: W68792.FS

PURPOSE

This memorandum discusses the objectives, field procedures, and the sampling locations for sediment sampling at the Laskin Poplar Oil site.

The Phase II RI work plan proposed sediment sampling in the freshwater and retention ponds to refine the nature of contamination in the pond sediments for use in the baseline risk assessment. Two sediment samples were to be taken from each pond, for a total of four samples.

Additional sediment sampling was proposed in Work Plan Revision Request (WPRR) No. 3. Sampling was proposed to assess the nature and extent of contamination in the sediments above and just below the Village of Jefferson Wastewater Treatment Plant. Sediment samples were not collected around and above the treatment plant in the Phase I RI work, and contamination was identified in Phase I RI sediment samples downstream of the plant but upstream of the site. Therefore, additional samples were required for evaluating the contamination upstream of the site. Two sediment samples from seeps coming from the site were also proposed in WPRR No. 3.

METHODOLOGY

Sediment sampling locations in the onsite ponds, Cemetery Creek, and seeps are shown in Figure B-8-1. Pond sediment sampling locations were identified in the bathymetric survey. Other sample locations were identified during site reconnaissance. Table B-8-1 lists the samples collected at each location and the rationale for collecting them. Table B-8-2 presents the types of analyses performed on each sample.

The sediment sampling team was made up of:

- Randy Videkovich, CH2M HILL, Site Safety Officer (SSO)
- Kevin Olson, CH2M HILL
- Angelo Liberatore, CH2M HILL
- Alan Esko, Engineers International, Inc.

Sediment sampling was performed on December 7 and 9-10, 1987. All pond samples were collected from a boat using a 20-inch stainless steel corer with a 2-inch I.D. VOA bottles (2 to 4 oz.) were filled immediately upon retrieving the corer. All other samples were filled from a composite from two cores blended in a stainless steel bowl. The stainless steel corer was also used at locations SD87-08 and SD87-10 in Cemetery Creek. Stainless steel scoops were used to collect the samples at the two seep locations and at Cemetery Creek location SD87-09.

A replicate sample (FR87-06) was collected at location SD87-06. The sediment blank, which was collected as a combined sediment/surface soil blank (FB87-02), consisted of clean sand scooped with a stainless steel scoop into the sample bottles.

Sampling equipment was decontaminated between locations with a trisodium phosphate solution, a water rinse, a methanol water rinse (approximately 10 percent methanol in distilled water), followed by a triple rinse with distilled water.

SITE SAFETY CONCERNS

Work on the freshwater pond was performed in Level D protection. Both people in the boat also wore U.S. Coast Guard approved life vests. The person collecting the sample had a safety line attached around his waist. The SSO was onshore with a life ring.

Level C protection was used at all times on the retention pond for people in the boat and the SSO. Continuous

Table B-8-1
SEDIMENT SAMPLES

Location	Samples	Rationale
Freshwater Pond	SD87-01	Deepest area of pond, most likely to accumulate contaminants.
	SD87-02	Inlet to pond from irrigation ditch and drainage from the fairgrounds. Establish sediment quality on the south end of the pond and near the inlet.
Retention Pc	SD87-04	East part of pond, near inlets of drains from the greenhouse and other portions of the Laskin property.
	SD87-05	West part of pond, near the inlet fed by surface water runoff from within the exclusion zone.
Seep 1	SD87-06 FR87-06	Seep in toe of slope just north of retention pond. Mr. Laskin stated that this seep is from a buried pipe draining from the retention pond.
Seep 2	SD87-07	Seep in ravine west of site near Cemetery Creek, assumed to be a discharge boundary for surficial aquifer.
Cemetery Creek	SD87-08	Upstream of easternmost Phase I RI sample but downstream of ravine draining the fairgrounds. Assess nature and extent of contamination upstream of the site. Previous sample indicated upstream contamination.
	SD87-09	Upstream of ravine draining the fairgrounds but downstream from Jefferson WWTP discharge. Assess nature and extent of contamination upstream of the site. Previous sample indicated upstream contamination.
	SD87-10	Upstream of Jefferson WWTP discharge. Assess nature and extent of contamination upstream of the site. Previous sample indicated upstream contamination.

Note: Samples beginning with "FR" are replicates. For example, the replicate for sample SD87-06 is FR87-06.

Table B-8-2

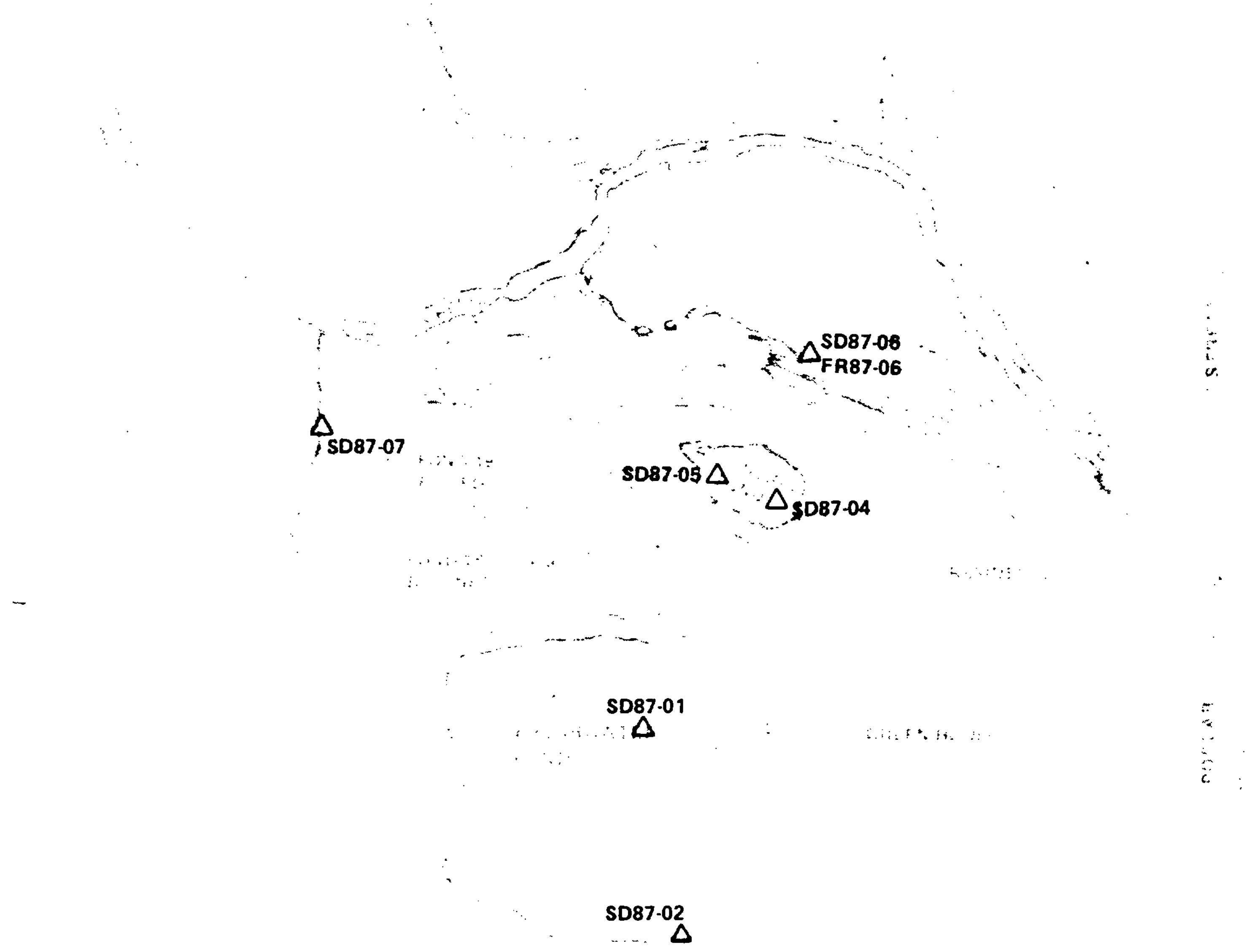
SAMPLE MATRIX FOR SEDIMENT SAMPLES

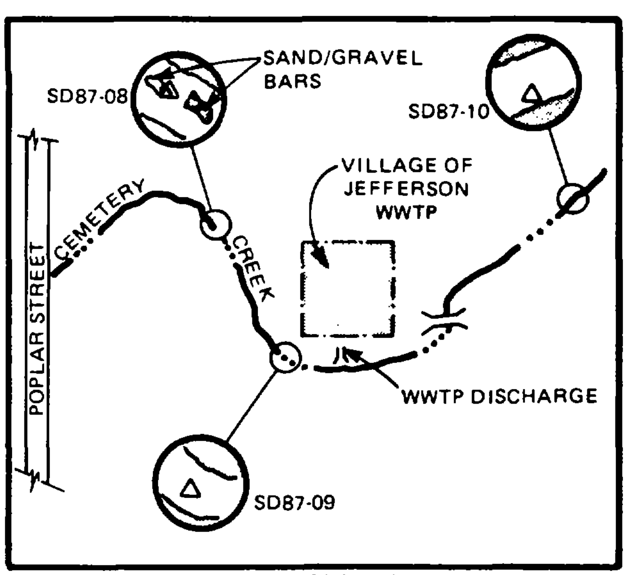
PHASE II RI

LOCATION	SAMPLE NUMBER	SAMPLE DATE	RAS ANALYSES							SAS ANALYSES AND LABS			
			CRL NUMBER	CASE NUMBER	OTR	ORGANIC LAB VOA	ORGANIC LAB BNA	METALS/Cn ITR	METALS/Cn LAB	SAS NUMBER	LOWER DL PAH'S	TOC,CEC	Incin. (1)
Freshwater Pond	LP-SD87-01	10-Dec-87	88HW01S61	8690	ES507	EA Eng	Specs	MEM456	Enseco	3466E		142	
"	LP-SD87-02	10-Dec-87	88HW01S62	"	ES508	"	"	MEM600	"	"		143	
Retention Pond	LP-SD87-04	09-Dec-87	88HW01S63	"	ES509	"	"	MER651	"	"		114	215
"	LP-SD87-05	09-Dec-87	88HW01S64	"	ES510	"	"	MER652	"	"		115	216
Seep 1	LP-SD87-06	10-Dec-87	88HW01S65	"	ES511	"	"	MER653	"	"	123	130	
"	LP-FR87-06	10-Dec-87	88HW01D65	"	ES513	"	"	MER655	"	"	124	131	
Seep 2	LP-SD87-07	10-Dec-87	88HW01S66	"	ES512	"	"	MER654	"	"	125	132	
Cemetery Creek	LP-SD87-08	07-Dec-87	88HW01S24	8648	EQ189	"	"	MEK988	"	"	34	45	
"	LP-SD87-09	07-Dec-87	88HW01S25	"	EQ190	"	"	MEK989	"	"	35	46	
"	LP-SD87-10	07-Dec-87	88HW01S26	"	EQ191	"	"	MEK990	"	"	36	47	

Notes

1 Incineration parameters include BTU, %Ash, %Vol Solids, %S %Cl





UPSTREAM SAMPLES
(APPROXIMATE SCALE: 1 IN = 500 FT)

LEGEND

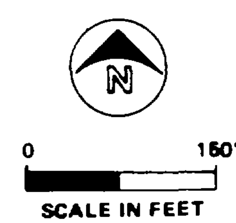


FIGURE B-8-1
PHASE II RI SEDIMENT SAMPLING LOCATIONS
LASKIN POPLAR

monitoring with a Foxboro 128GC organic vapor analyzer (OVA) and an explosimeter/oxygen meter was maintained at all times in the boat. At no time were low oxygen or explosive conditions observed. OVA readings in the breathing zone did not vary from background except during sample handling. When working over the samples, breathing zone OVA readings varied from 1 to 2 ppm above background.

All other sediment samples were collected in Level D protection. Saranex was worn at all times to prevent skin contact with water.

VISUAL OBSERVATIONS

The retention pond sample from the eastern part of the pond (SD87-04) was oily to a depth of 20 inches. The sample from the western end of the pond was not visibly contaminated and that end of the pond generally appeared to contain a less oily material, possibly fill. Otherwise, the soils in and around the pond are visibly oily.

Freshwater pond sediment samples were fine-grained with no visible contamination. Seep sediment samples were clayey with shale fragments. Visible amounts of oil were present on the sediment sample at SD87-06.

Cemetery Creek sediment samples were fine-grained with shale fragments throughout and exhibited no visible contamination.

GLT777/2

Fieldwork Memorandum B-9
SOIL SAMPLING

CH2M HILL

FIELDWORK MEMORANDUM B-9

TO: Donna Twickler, U.S. EPA Remedial Project Manager

FROM: Randy Videkovich, CH2M HILL Site Manager

PREPARED BY: Bob Weinschrott, CH2M HILL Sample Team Leader

DATE: February 24, 1988

RE: Phase II RI Soil Sampling
Laskin Poplar Oil Site
EPA WA 132-5N03

PROJECT: W68792.FS

OBJECTIVES

The evaluation of existing data for the Phase II RI Work Plan identified several data gaps in the determination of nature and extent of contamination soils on and around the Laskin Poplar Oil site. The work plan proposed collecting additional soil samples for refining the understanding of:

- o Vertical and horizontal extent of soil contamination affecting the boundaries of remediation for the baseline risk assessment.

- o The nature of soil contamination affecting the fate and transport determination and the baseline risk assessment.

- o Quantities of contaminated soil that may be affected by remedial actions.

The work plan proposed collecting subsurface and surface soil samples at 12 drilling locations inside and just outside of the site exclusion zone; 11 surface soil samples around the boiler house, greenhouses, and the Laskin residence; and 3 background surface soil samples from around Jefferson township. In addition, a work plan revision proposed collecting 3 surface soil samples from the Cemetery Creek flood plain upstream of the site.

METHODOLOGY

Soil sampling occurred during the month of December 1987. Surface and subsurface soil sampling locations from the Phase II RI fieldwork are indicated in Figures B-9-1 and B-9-2. Table B-9-1 presents the rationale for collecting samples at each location. Table B-9-2 presents the types of analyses for each sample collected.

The subsurface soil sampling team consisted of:

- Roger Huddleston, CH2M HILL, SSO/Levels D, C, and B
- Bob Weinschrott, CH2M HILL, SSO/Levels D and C
- Kevin Olson, CH2M HILL
- Glen Anderson, Engineers International, Inc.
- Scott Brockway, Engineers International, Inc.

The personnel listed above also collected the surface soil sample at each drilling location.

The surface soil sampling team consisted of:

- Bob Weinschrott, CH2M HILL, SSO/Levels D and C
- Randy Videkovich, CH2M HILL, SSO/Level D
- Angelo Liberatore, CH2M HILL
- Alan Esko, Engineers International, Inc.

Surface soil samples were collected with stainless steel scoops. Samples were collected from the 6- to 12-inch interval after the upper 6 inches of soil had been removed.

Subsurface soil samples were collected with 3-inch split-spoon samplers. Three-inch split spoons were substituted for the 2-inch spoons required in the subcontract documents because they produced larger sample volumes at each sample interval. Samples were composited in 4-foot intervals, beginning with the 2- to 6-foot interval. Four-foot intervals were required to obtain enough sample volume to fill the sample jars. In general, the sample intervals were successive 4-foot intervals beginning at 2 feet; however several borings had different intervals. The sample intervals are shown in the boring logs in Attachment 1 to Fieldwork Memorandum B-4.

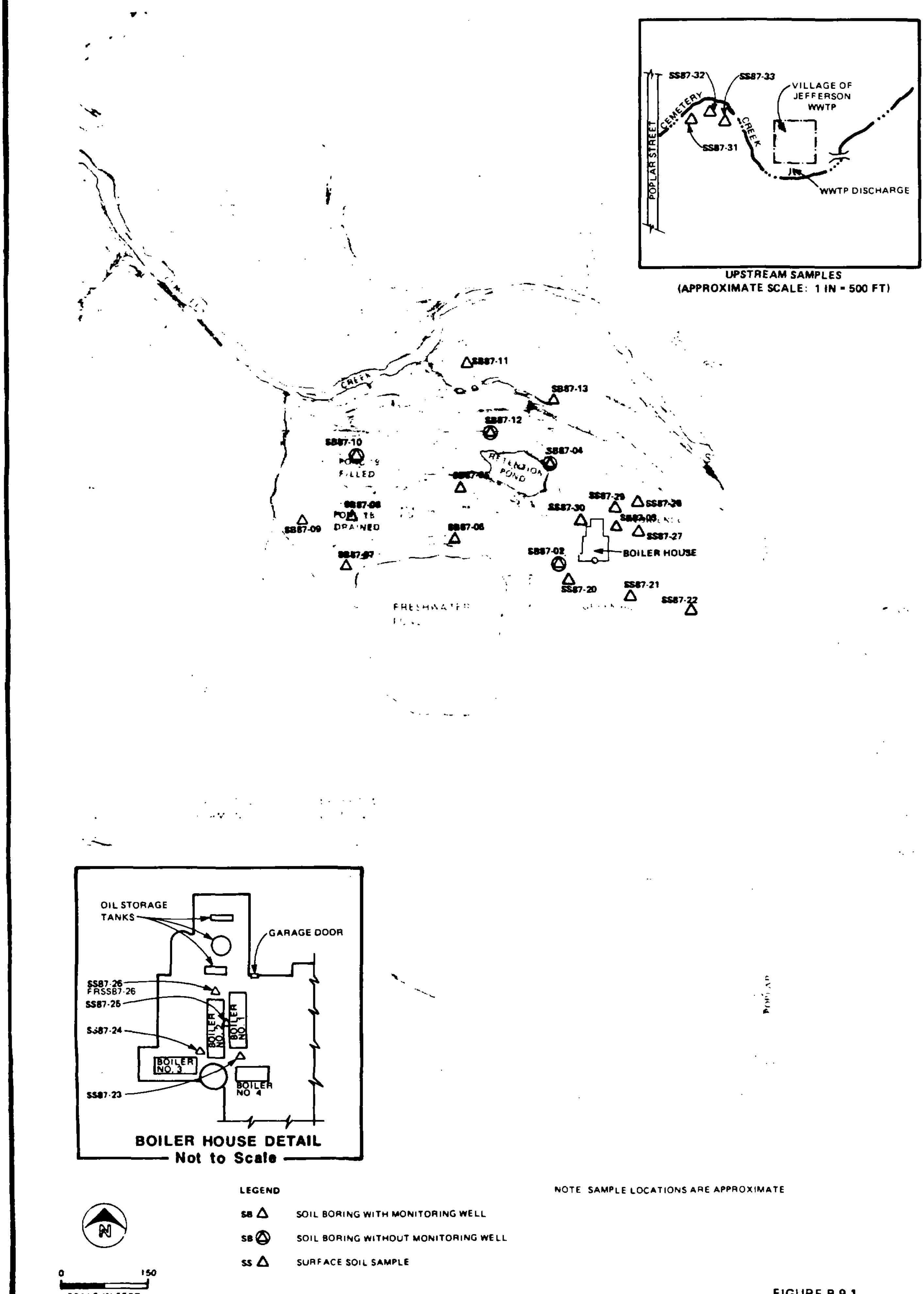
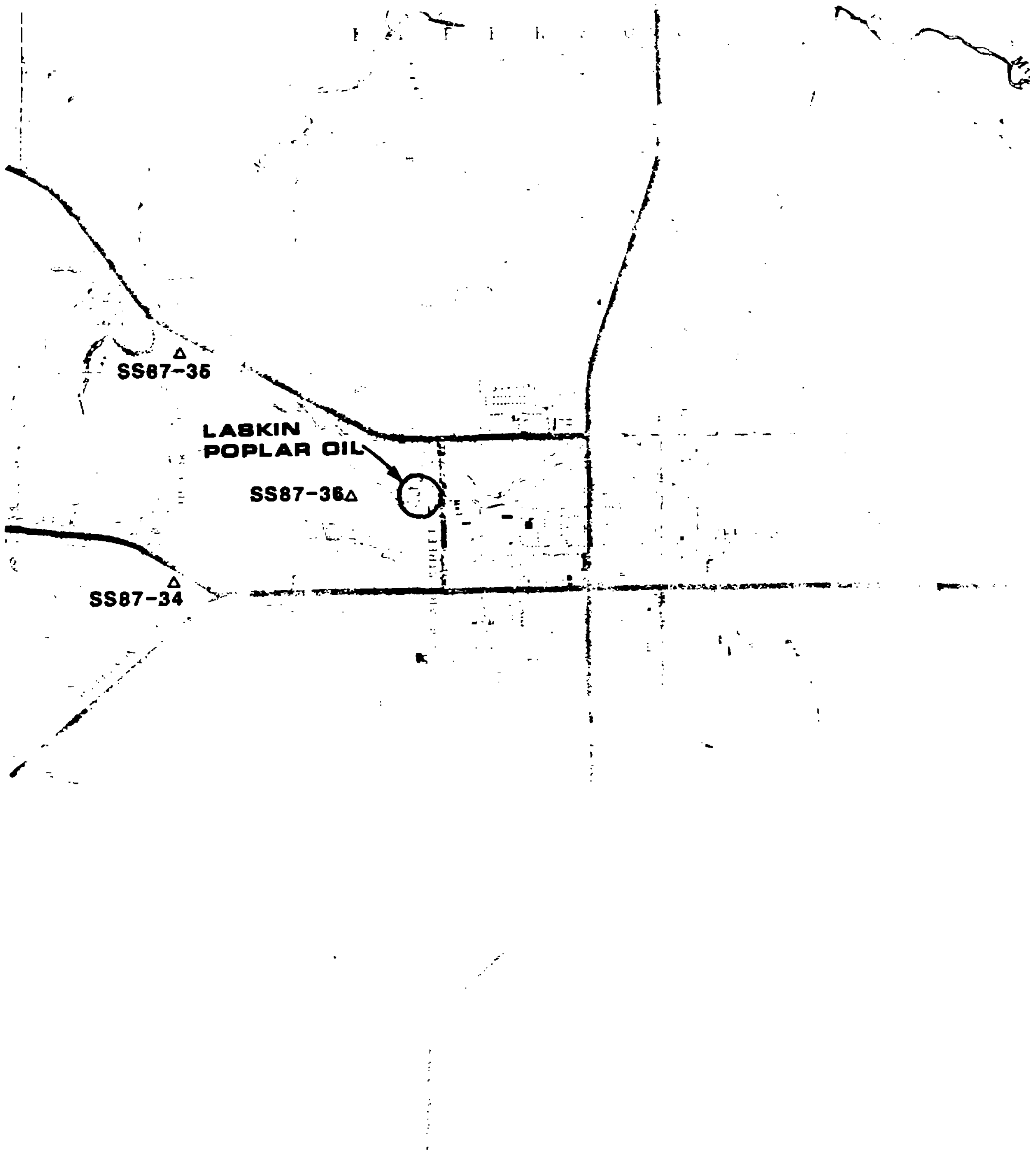


FIGURE B-9-1
PHASE II RI
ONSITE SOIL SAMPLE LOCATIONS
LASKIN POPLAR OIL



NOTE: SAMPLE LOCATIONS ARE APPROXIMATE.

SOURCE. United States Geological Survey, 7.5 Minute Quadrangles for Jefferson (1960, Photorev. 1985), Dorset (1959, Photorev. 1979), Gageville (1960, Photorev. 1979) and Ashtabula South (1960, Photorev. 1970), Ohio

0 2000
SCALE IN FEET

LEGEND

△ BACKGROUND SOIL SAMPLE

FIGURE B 9-2
PHASE II RI
BACKGROUND SOIL SAMPLING LOCATIONS
LASKIN POPLAR OIL

Table B-9-1 (Page 1 of 2)
SOIL SAMPLING LOCATIONS, SAMPLE NUMBERS
AND RATIONALE FOR SAMPLE COLLECTION

Location	Samples	Rationale	Monitoring Well in Boring
Outside boiler house, near SN109	SS87-02 SB87-02-??	Define vertical extent of contamination where surface contamination is established	None
Northeast corner of boiler house, outside near residence	SS87-03 SB87-03-??	Define vertical extent of contamination where there is no existing information	GW87-03
Southeast of retention pond, between B-2 and SN015	SS87-04 SB87-04-??	Define vertical extent of contamination where surface contamination is established	None
Between and just north of pits 2 and 3	SS87-05 SB87-05-??	Vertical extent of contamination check for consistency with PRP results	GW87-05
Between pit 3 and freshwater pond, close to pond	SW87-06 SB87-06-??	Define southern extent of contamination from pits; define properties of soils in fill around Freshwater pond	GW87-06
Northwest corner of freshwater pond	SS87-07 SB87-07-??	Define nature of contamination between pits and pond	GW87-07
Vicinity of pond 18	SS87-08 SB87-08-??	Define western extent of contaminated soil	GW87-08
Vicinity of pond 18	SS87-09 SB87-09-??	Define western extent of contaminated soil	GW87-09
Drilled through filled pond 19	SS87-10 SS87-10-??	Define the nature and extent of contamination in filled pond 19	None
North of SN003 and SN007, across road	SS87-11 SB87-11-??	Define northern extent of contaminated soil	GW87-11
North of retention pond, slightly north of the road	SS87-12 SB87-12-??	Define northern extent of contaminated soil	None

Table B-9-1 (Page 2 of 2)

Location	Samples	Rationale	Monitoring Well in Boring
Northeast of retention pond, between between road and slope	SS87-13 SB87-13-??	Define northern extent of contaminated soil	GW87-13
Inside boiler house	SS87-23 SS87-24 SS87-25 SS87-26 FR87-26	Establish extent of contaminated soil, surface contamination established in nearby soils	
Inside greenhouse	SS87-20 SS87-21 SS87-22	Establish extent of contaminated soils	None
Between boiler house and residence	SS87-27 SS87-28 SS87-29 SS87-30	Establish extent of contaminated soils	None
Background	SS87-34 SS87-35 SS87-36	Obtain additional background as data, new HSL data, and background data at the lower QLs	None
Cemetery Creek	SS87-31 SS87-32 SS87-33	Assess nature of contamination upstream of site where contaminated sediments have been identified	None

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Table B-9-2

SAMPLE MATRIX FOR SOIL SAMPLES
PHASE II RI

LOCATION	SAMPLE NUMBER	SAMPLE DATE	RAS ANALYSES							SAS ANALYSES AND LABS						
			CRL NUMBER	CASE NUMBER	OTR	ORGANIC LAB VOA	ORGANIC LAB BNA	METALS/Cn ITR	METALS/Cn LAB	SAS NUMBER	LOWER DLs PAH'S	TOC,CEC	PCDD/ PCDF (1)	Incin. (2)	SAS NUMBER	INDEX PROPERTIES
SB87-02	LP-SS87-02	09-Dec-87	88HW01S75	8690	ES522	EA Eng	Specs	MES313	Enseco	3466E		107				
	LP-SB87-02-01	09-Dec-87	88HW01S76	"	ES523	"	"	MES314	"	"	103	118				
	LP-SB87-02-02	09-Dec-87	88HW01S77	"	ES524	"	"	MES315	"	"	104	119				
	LP-SB87-02-03	09-Dec-87	88HW01S78	"	ES525	"	"	MES316	"	"	105	120				
	LP-SB87-02-04	09-Dec-87	88HW01S79	"	ES526	"	"	MES317	"	"		121				
	LP-SB87-02-05	09-Dec-87	88HW01S80	"	ES537	"	"	MES318	"	"	106	122				
SB87-03	LP-SS87-03	16-Dec-87	88HW01S99	8690	ES553	EA Eng	Specs	MES345	Enseco	"	172	164				
	LP-SB87-03-01	16-Dec-87	88HW01S83	"	ES538	"	"	MES319	"	"		159				
	LP-SB87-03-02	16-Dec-87	88HW01S91	"	ES546	"	"	MES327	"	"	170	160				
	LP-SB87-03-03	16-Dec-87	88HW01S96	"	EQ181	"	"	MEK980	"	"	171	161				
	LP-SB87-03-04	16-Dec-87	88HW01S97	"	ES503	"	"	MES251	"	"		162				
	LP-SB87-03-05	16-Dec-87	88HW01S98	"	ES552	"	"	MES344	"	"		163				
	LP-SB87-03-06	16-Dec-87	88HW02S02	"	ES528	"	"	MES347	"							
SB87-04	LP-SS87-04	10-Dec-87	88HW01S84	8690	ES539	EAENG	SPECT	MES320	ENSEN	"	126	135			3860E	9
	LP-SB87-04-01	10-Dec-87	88HW01S85	"	ES540	"	"	MES321	"	"	127	136			"	10
	LP-SB87-04-02	10-Dec-87	88HW01S86	"	ES541	"	"	MES322	"	"		137			"	11
	LP-SB87-04-03	10-Dec-87	88HW01S87	"	ES542	"	"	MES323	"	"	128	138			"	12
	LP-SB87-04-04	10-Dec-87	88HW01S88	"	ES543	"	"	MES324	"	"		139			"	13
	LP-SB87-04-05	10-Dec-87	88HW01S89	"	ES544	"	"	MES325	"	"	129	140				
	LP-SB87-04-06	10-Dec-87	88HW01S90	"	ES545	"	"	MES326	"	"		141				
SB87-05	LP-SS87-05	09-Dec-87	88HW01S67	8690	ES514	"	"	MER656	"	"	95	108				
	LP-SB87-05-01	09-Dec-87	88HW01S68	"	ES515	"	"	MER657	"	"	96	109				
	LP-SB87-05-02	09-Dec-87	88HW01S69	"	ES516	"	"	MER658	"	"	97	110		212		
	LP-SB87-05-03	09-Dec-87	88HW01S70	"	ES517	"	"	MER659	"	"	98	111				
	LP-SB87-05-04	09-Dec-87	88HW01S71	"	ES518	"	"	MER660	"	"	99	112		213		
	LP-SB87-05-05	09-Dec-87	88HW01S72		ES519	"	"	MER661	"	"	100	113		214		
	LP-SB87-05-06	09-Dec-87	88HW01S73		ES520	"	"	MER662		"		116				
	LP-SB87-05-07	09-Dec-87	88HW01S74		ES521	"	"	MES312		"		117				
	LP-SB87-05-08	10-Dec-87	88HW01S81		EQ237	"	"	MER546		"		133		217		
	LP-SB87-05-09	10-Dec-87	88HW01S82		EQ198	"	"	MEM523		"		134		218		
SB87-06	LP-SS87-06	17-Dec-87	88HW02S05	8740	ES531	VERSR	PEI	MER680	IIII	"		182		224		
	LP-SB87-06-01	17-Dec-87	88HW02S06	"	ES532	"	"	MER681	"	"	191	183		225	"	14

Table 8-9-2

SAMPLE MATRIX FOR SOIL SAMPLES
PHASE II RI

LOCATION	SAMPLE NUMBER	SAMPLE DATE	RAS ANALYSES: CRL NUMBER	RAS ANALYSES: CASE NUMBER	RAS ANALYSES: DTR	RAS ANALYSES: ORGANIC LAB VOA	RAS ANALYSES: ORGANIC LAB BNA	RAS ANALYSES: METALS/Cn ITR	RAS ANALYSES: METALS/Cn LAB	SAS ANALYSES AND LABS: SAS NUMBER	SAS ANALYSES AND LABS: LOWER DLs PAH's	SAS ANALYSES AND LABS: TOC,CEC	SAS ANALYSES AND LABS: PCDD/PCDF (1)	SAS ANALYSES AND LABS: Incin. (2)	SAS ANALYSES AND LABS: SAS NUMBER	SAS ANALYSES AND LABS: INDEX PROPERTIES
	LP-SB87-06-02	17-Dec-87	88HW02S07	"	ES533	"	"	MES350	"	"		184				
	LP-SB87-06-03	17-Dec-87	88HW02S08	"	ES534	"	"	MER663	"	"	192	185		226	"	15
	LP-SB87-06-04	17-Dec-87	88HW02S09	"	ES535	"	"	MER664	"	"		186				
	LP-SB87-06-05	17-Dec-87	88HW02S10	"	ES536	"	"	MER665	"	"	193	187		227		
	LP-SB87-06-06	17-Dec-87	88HW02S11	"	ES554	"	"	MER666	"	"		188		228		
	LP-SB87-06-07	17-Dec-87	88HW02S03	"	ES529	"	"	MES348	"	"		189				
	LP-SB87-06-08	17-Dec-87	88HW02S04	"	ES530	"	"	MES349	"	"	194	190				
SB87-07	LP-SS87-07	04-Dec-87	88HW01S16	8648	EQ179	Versem	AATS	MEK978	Enseco	"	11	18				
	LP-SB87-07-01	04-Dec-87	88HW01S17	"	EQ180	"	"	MEK979	"	"	12	19				
	LP-FR87-07-01	04-Dec-87	88HW01D17	"	EQ188	"	"	MEK987	"	"	13	20				
	LP-SB87-07-02	04-Dec-87	88HW01S11	"	EQ174	"	"	MEK973	"	"	14	21				
	LP-SB87-07-03	04-Dec-87	88HW01S10	"	EQ173	"	"	MEK972	"	"	17	24				
	LP-SB87-07-04	04-Dec-87	88HW01S19	"	EQ182	"	"	MEK981	"	"		25				
	LP-SB87-07-05	04-Dec-87	88HW01S20	"	EQ183	"	"	MEK982	"	"		26				
SB87-08	LP-SS87-08	07-Dec-87	88HW01S08	"	EQ171	"	"	MEK970	"	"	33	44		201	"	15
	LP-SB87-08-01	07-Dec-87	88HW01S03	8648	EQ165	Versem	AATS	ME1785	Enseco	"	30	40		197	"	1
	LP-SB87-08-02	07-Dec-87	88HW01S04	"	EQ166	"	"	ME1786	"	"	31	41		198	"	2
	LP-SB87-08-03	07-Dec-87	88HW01S05	"	EQ167	"	"	MEK963	"	"	32	42		199	"	3
	LP-SB87-08-04	07-Dec-87	88HW01S33	"	EQ199	"	"	MEM524	"	"		43		200	"	4
SB87-09	LP-SS87-09	16-Dec-87	88HW01S06	8690	EQ168	EA Eng	PEI	MEK968	Enseco	"	166	154		219		
	LP-SB87-09-01	16-Dec-87	88HW01S07	"	EQ169	"	"	MEK969	"	"		155		220		
	LP-SB87-09-02	16-Dec-87	88HW01S30	"	EQ195	"	"	MEK994	"	"	167	156		221		
	LP-SB87-09-03	16-Dec-87	88HW01S31	"	EQ196	"	"	MEM521	"	"	168	157		222		
	LP-SB87-09-04	16-Dec-87	88HW01S32	"	EQ197	"	"	MEM522	"	"	169	158		223		
	LP-SB87-09-05	16-Dec-87	88HW02S01	"	ES527	"	"	MES346	"	"		165				
SB87-10	LP-SS87-10	08-Dec-87	88HW01S41	8690	EQ223	Aquat	PEI	MEM533	Ensen	"	65	56		207		
	LP-SB87-10-01	08-Dec-87	88HW01S42	"	EQ224	"	"	MEM534	"	"	66	57		208	"	6
	LP-SB87-10-02	08-Dec-87	88HW01S43	"	EQ225	"	"	MEM535	"	"	67	58		209	"	7
	LP-SB87-10-03	08-Dec-87	88HW01S44	"	EQ226	"	"	MEM536	"	"	68			210	"	8
	LP-SB87-10-04	08-Dec-87	88HW01S45	"	EQ227	"	"	MEM537		"		60		211		
	LP-SB87-10-05	08-Dec-87	88HW01S46	"	EQ228	"	"	MEM538	"	"		61				

Table 8-9-2

SAMPLE MATRIX FOR SOIL SAMPLES
PHASE II RI

LOCATION	SAMPLE NUMBER	SAMPLE DATE	RAS ANALYSES CRL NUMBER	CASE NUMBER	OTR	ORGANIC LAB VOA	ORGANIC LAB BNA	METALS/CN ITR	METALS/CN LAB	SAS ANALYSES AND LABS SAS NUMBER	LOWER DLS PAH'S	TOC,CEC	PCDD/ PCDF (1)	Incin. (2)	SAS NUMBER	INDEX PROPERTIES
SB87-11	LP-SS87-11	08-Dec-87	88HW01S09	8690	EQ173	Aquat	PEI	MEK971	Ensen	"	71	69				
	LP-SB87-11-01	08-Dec-87	88HW01S21	"	EQ184	"	"	MEK983	"	"	72	70				
	LP-SB87-11-02	08-Dec-87	88HW01S22	"	EQ185	"	"	MEK984	"	"	73	82				
	LP-SB87-11-03	08-Dec-87	88HW01S23	"	EQ186	"	"	MEK985	"	"	74	83				
	LP-SB87-11-04	08-Dec-87	88HW01S54	"	EQ236	"	"	NC (3)	"	"						
SB87-12	LP-SS87-12	18-Dec-87	88HW02S12	8740	ES556	Versr	PEI	MER668	EEEI	"	241	229				
	LP-FR87-12	18-Dec-87	88HW02D12	8740	ES563	Versr	PEI	MER675	EEEI	"	242	230				
	LP-SB87-12-01	18-Dec-87	88HW02S13	"	ES557	"	"	MER669	"	"	243	231				
	LP-FR87-12-01	18-Dec-87	88HW02D13	"	ES564	"	"	MER676	"	"	244	232				
	LP-SB87-12-02	18-Dec-87	88HW02S14	"	ES558	"	"	MER670	"	"	245	233				
	LP-SB87-12-03	18-Dec-87	88HW02S15	"	ES559	"	"	MER671	"	"		234				
	LP-FR87-12-03	18-Dec-87	88HW02D15	"	ES565	"	"	MER677	"	"		235				
	LP-SB87-12-04	18-Dec-87	88HW02S16	"	ES560	"	"	MER672	"	"	246	236				
	LP-SB87-12-05	18-Dec-87	88HW02S17	"	ES561	"	"	MER673	"	"		237				
	LP-SB87-12-06	18-Dec-87	88HW02S18	"	ES562	"	"	MER674	"	"	247	238				
SB87-13	LP-SS87-13	03-Dec-87	88HW01S15	8648	EQ178	MART	AATS	MEK977	Ensen	"	04	09				
	LP-SB87-13-01	03-Dec-87	88HW01S12	"	EQ175	"	"	MEK974	"	"	01	06				
	LP-SB87-13-02	03-Dec-87	88HW01S13	"	EQ176	"	"	MEK975	"	"	02	07				
	LP-FR87-13-02	03-Dec-87	88HW01D13	"	EQ187	"	"	MEK986	"	"	05	10				
	LP-SB87-13-03	03-Dec-87	88HW01S14	"	EQ177	"	"	MEK976	"	"	03	08				
Greenhouse	LP-SS87-20	08-Dec-87	88HW01S52	8690	EQ234	Aquat	PEI	MEM544	Ensen	"	77	88				
"	LP-SS87-21	08-Dec-87	88HW01S51	"	EQ233	"	"	MEM543	"	"	75	84				
"	LP-SS87-22	08-Dec-87	88HW01S53	"	EQ235	"	"	MEM545	"	"	76	85				
Boiler House	LP-SS87-23	08-Dec-87	88HW01S37	"	EQ218	"	"	MEM528	"	"		51	173	202		
"	LP-SS87-24	08-Dec-87	88HW01S38	"	EQ219	"	"	MEM529	"	"		52	174	203		
"	LP-SS87-25	08-Dec-87	88HW01S39	"	EQ220	"	"	MEM530	"	"		53	175	204		
"	LP-SS87-26	08-Dec-87	88HW01S40	"	EQ221	"	"	MEM531	"	"		54	176	205		
	LP-FR87-26	08-Dec-87	88HW01D40	"	EQ222	"		MEM532	"	"		55	177	206		
N. of boiler house	LP-SS87-27	08-Dec-87	88HW01S47		EQ229	"	"	MEM539	"	"	78	89	178			
"	LP-SS87-28	08-Dec-87	88HW01S48		EQ230	"	"	MEM540	"	"	79	86	179			
"	LP-SS87-29	08-Dec-87	88HW01S49	"	EQ231		"	MEM541	"	"	81	87	181			
"	LP-SS87-30	08-Dec-87	88HW01S50	"	EQ232	"	"	MEM542	"	"	80	90	180			

Table 8-9-2

SAMPLE MATRIX FOR SOIL SAMPLES
PHASE II RI

LOCATION	SAMPLE NUMBER	SAMPLE DATE	RAS ANALYSES							SAS ANALYSES AND LABS						
			CRL NUMBER	CASE NUMBER	OTR	ORGANIC LAB VOA	ORGANIC LAB BNA	METALS/Cn ITR	METALS/Cn LAB	SAS NUMBER	LOWER DLs PAH's	TOC,CEC	PCDD/ PCDF (1)	Incin. (2)	SAS NUMBER	INDEX PROPERTIES
Cem. Ck. Floodplain	LP-SS87-31	07-Dec-87	88HW01S27	8648	EQ192	Versm	AATS	MEK991	"	-	27	37				
"	LP-SS87-32	07-Dec-87	88HW01S28	"	EQ193	"	-	MEK992	"	"	28	38				
"	LP-SS87-33	07-Dec-87	88HW01S29	"	EQ194	"	-	MEK993	"	"	29	39				
Background	LP-SS87-34	08-Dec-87	88HW01S34	8690	EQ200	Aqual	PEI	MEM525	"	"	62	48				
"	LP-SS87-35	08-Dec-87	88HW01S35	"	EQ216	"	"	MEM526	-	-	·63	49				
"	LP-SS87-36	08-Dec-87	88HW01S36	"	EQ217	"	"	MEM527	"	-	64	50				
BLANKS																
Subsurface Soil	LP-FB01	04-Dec-87	88HW01S01	8648	EQ163	VERSA	AATS	ME1783	Ensen	-	15			195		
Surface Soil	LP-FB02	04-Dec-87	88HW01S02	"	EQ164	"	-	ME1784	"	-	16	23		196		
Subsurface Soil	LP-FB87-04	18-Dec-87	88HW02S19	8740	ES566	Versr	PEI	MER678	EEI	"		239				
* Surface Soil	LP-FB87-05	18-Dec-87	88HW02S20	"	ES555	-	"	MER667	-	"	249	240				

Notes:
(1) PCDD/PCDF includes tetra and higher polychlorinated dibenzo-p-dioxins and dibenzofurans.
(2) Incineration paratmeters includeBTU, %Ash, %Vol. Solids, %S %Cl
(3) Sample not collected due to limited sample volume

Replicate samples were collected for soil borings SB87-07-01, SS87-12, SB87-12-03, SB87-13-02, and SS87-26. Blank samples for the subsurface soils samples were collected by pouring clean sand into a decontaminated split-spoon sampler and then pouring the sand from the split spoons into the sample bottles. Surface soil blanks were collected with a decontaminated stainless steel scoop and were sampled by scooping clean sand directly into sample bottles.

Shelby tube samples were collected on January 12, 1988 from the vicinity of borings SB87-04, SB87-10, and SB87-12. Two Shelby tubes were pushed at boring No. SB87-04, two at SB87-10, and two at SB87-12. However, due to poor sample recovery, only one Shelby tube was retained from boring No. SB87-12. Shelby tubes were pushed after drilling to the desired depth with a hollow-stem auger.

Sampling equipment was decontaminated between samples with a trisodium phosphate solution, a water rinse, and a methanol water rinse (approximately 10 percent methanol in distilled water), followed by a triple rinse of distilled water. Surface sampling equipment was decontaminated after each sampling location. Subsurface sampling equipment was decontaminated after each 4-foot interval.

SITE SAFETY CONCERNS

Surface and subsurface soil sampling was performed in levels of protection D, C, and B. Site safety information for the subsurface soil sampling is presented in Fieldwork Memorandum B-4. Specifically, Table B-4-3 lists the highest level of safety protection used at each drilling location.

All surface soil sampling except the boiler house sampling was performed in Level D. Sampling was monitored continuously with a Foxboro 128GC organic vapor analyzer (OVA) or HNu PI 101 photoionizer and an explosimeter/oxygen meter. At no time did OVA or HNu breathing zone readings vary from background or were low oxygen or explosive conditions encountered. Level C protection was utilized in the boiler house because of the possible presence of polychlorinated dibenzo-p-dioxins and dibenzofurans. MSA GMC-H cartridges were used for the respirators to provide protection from particulates that might contain polychlorinated dibenzo-p-dioxins or dibenzofurans. At no time did conditions vary from background.

VISUAL OBSERVATIONS

Descriptions based upon visual observation of subsurface soil samples are provided in the boring logs in Attachment 1 to Fieldwork Memorandum B-4.

The Cemetery Creek flood plain soil samples are described as silty sand with some rock fragments and root fragments. The background soil samples ranged from a sandy silt to silt with peat. The greenhouse samples were silty with visible organic matter, primarily roots and humus. The samples collected outside the boiler house and near the Laskin residence were typically silty with much gravel since the samples were collected in the driveways. The boiler house samples typically appeared to be fly ash mixed with the native soils. Two of the boiler house sample locations (SS87-23 and SS87-24) were black and oily in appearance.

GLT777/58

Fieldwork Memorandum B-10
GROUNDWATER MONITORING WELL AND RESIDENTIAL WELL SAMPLING

GLT777/48-10

FIELDWORK MEMORANDUM B-10

CH2M HILL

TO: Donna Twickler, U.S. EPA Remedial Project Manager

FROM: Randy Videkovich, CH2M HILL Site Manager

PREPARED BY: Bob Weinschrott, CH2M HILL Sample Team Leader

DATE: March 9, 1988

RE: Phase II RI Groundwater Monitoring Well and Residential Well Sampling
Laskin Poplar Oil Site
EPA WA 132-5N03

PROJECT: W68792.FQ

OBJECTIVES

The evaluation of existing data for the Phase II RI Work Plan identified several data gaps in the determination of the nature and extent of groundwater contamination at the Laskin Poplar Oil site. The Phase II RI Work Plan proposed the following tasks:

- o Sample the existing wells again to refine the existing data base on groundwater contamination.
- o Sample Phase II monitoring wells on and around the site to develop an understanding of nature and extent of groundwater contamination offsite and to refine the understanding of the nature and extent of groundwater contamination at the site.

A work plan revision was submitted, in accordance with an U.S. EPA request, to include residential well sampling in the groundwater sampling effort. The residential wells that were sampled are the closest downgradient (northwest) wells.

METHODOLOGY

Monitoring well sampling locations for both Phases I and II RI are shown on Figure B-10-1; residential well locations are shown on Figure B-10-2. The rationale for the monitoring well locations can be found in Fieldwork Memorandums B-4 and B-9. Sampling was performed from February 1 to 5 and on February 8, 1988.

The monitoring well groundwater sampling team included the following personnel:

- Bob Weinschrott, CH2M HILL, SSO/Levels D, C, and B, Team Leader
- Kevin Olson, CH2M HILL
- Randy Videkovich, CH2M HILL, Project Manager
- Jeff Keiser, CH2M HILL
- Jeff Sepesi, CH2M HILL
- Glen Anderson, Engineers International, Inc.
- Scott Brockway, Engineers International, Inc.
- Alan Esko, Engineers International, Inc.
- Feraidoun Tafaghodi, Engineers International, Inc.

The residential well sampling team consisted of:

- Bob Weinschrott, CH2M HILL, SSO, Team Leader
- Donna Twickler, U.S. EPA Remedial Project Manager
- Michelle Redfield, U.S. EPA

Monitoring well groundwater samples were collected with 4 and 5-foot stainless steel bailers. At least five well volumes were bailed from all wells on the basis of static water level and well installation details. If a well recovered slowly and did not have enough water to bail five volumes, it was bailed dry twice and then sampled. VOA (RAS and SAS) vials were filled first, followed by the remaining RAS bottles, and then the remaining SAS bottles. If there was an insufficient volume of water, the bottles were filled in the order listed above. Bottles for RAS organic compounds were filled preferentially before bottles for RAS metals and cyanide.

Monitoring wells GW87-06D and GW87-16D were dry following bailing and could not be sampled. Replicate samples were collected for wells GW005-87, GW87-11, and GW87-13. Blank samples were collected by pouring HPLC grade water into decontaminated bailers and then filling the bottles.

Bailers were decontaminated between locations with a trisodium phosphate solution, a water rinse, a methanol water rinse (approximately 10 percent methanol in distilled water), and a final triple rinse with distilled water.

Residential well samples were collected from 10 residences on Doyle Road, approximately 1/2 mile northwest of the site. The 10 wells were identified as the closest wells

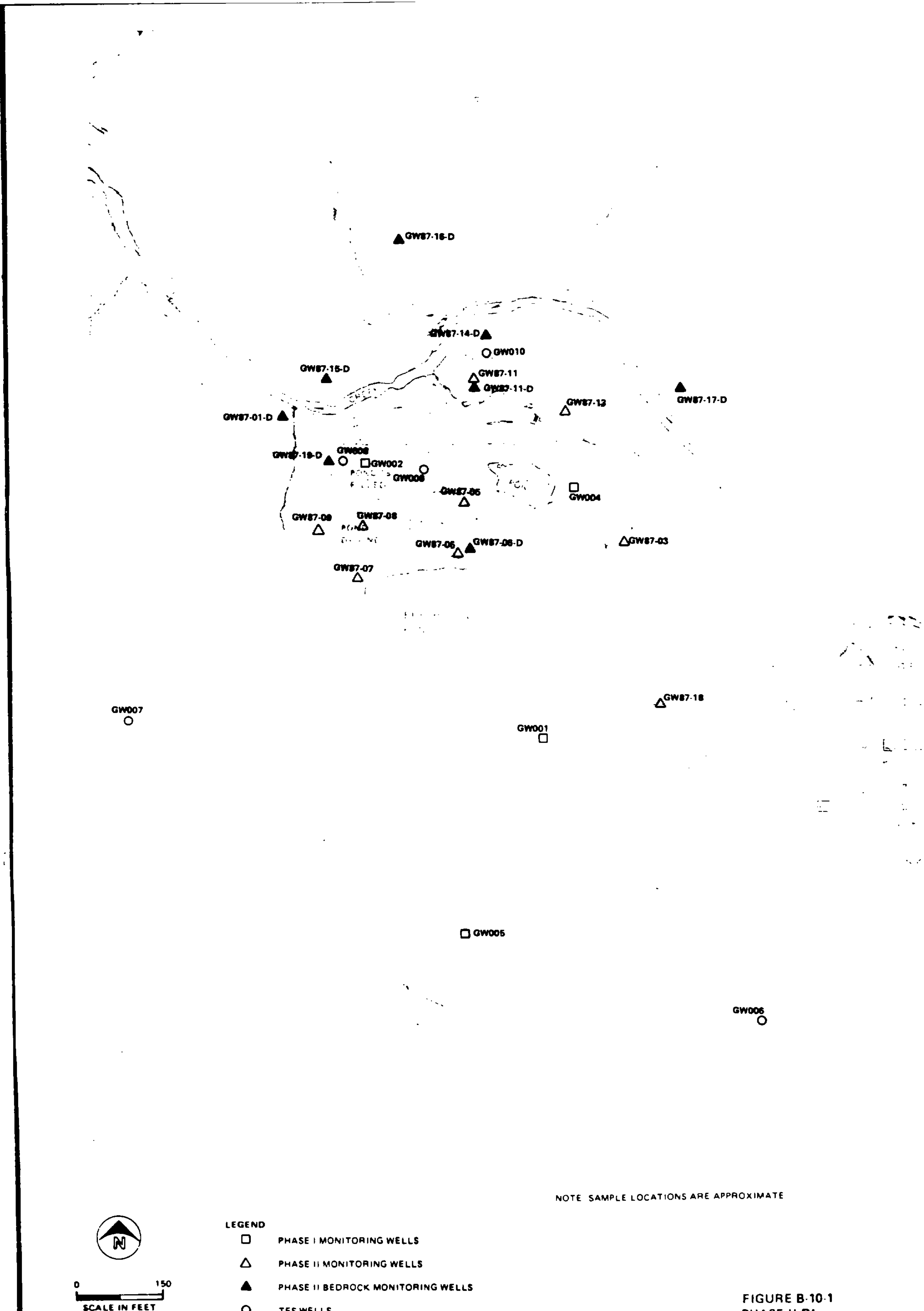
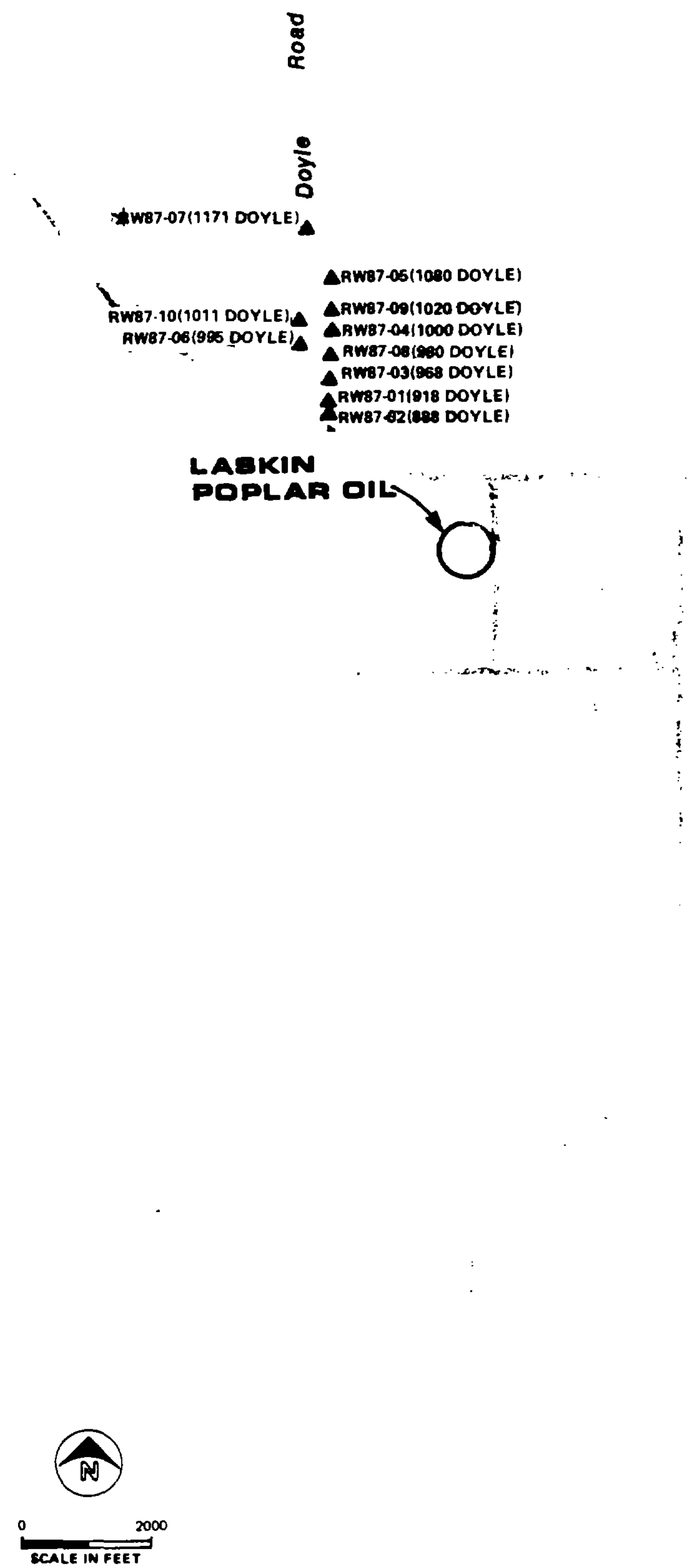


FIGURE B-10-1
PHASE II RI
GROUNDWATER SAMPLING
LOCATIONS
LASKIN POPLAR OIL



SOURCE. United States Geological Survey, 7.5 Minute Quadrangles for Jefferson (1960, Photorev. 1985), Dorset (1959, Photorev 1979), Gageville (1960, Photorev. 1979) and Ashtabula South (1960, Photorev. 1970), Ohio.

FIGURE B-10-2
APPROXIMATE RESIDENTIAL WELL LOCATIONS
LASKIN POPLAR

01-Jul-88

Table B-10-2

SAMPLE MATRIX FOR RESIDENTIAL WELL SAMPLES
PHASE II RI

SAMPLE NUMBER	SAMPLE DATE	RAS ANALYSES						SAS ANALYSIS AND LABS				
									LOWER DETECTION LIMIT			TSS
		CASE NUMBER	OTR	LAB	CASE NUMBER	ITR	LAB	SAS NUMBER	VOCs	PHENOL	MERCURY	
RW87-01	02/08/87	8976/ 3339E	ES582	S-Cubed	3554E	MER745	CHEMTEC	3466E	321	321	SAS # 16 CRL	299
RW87-02	"	"	ES583	"	"	MER746	"	"	322	322	"	300
RW87-03	"	"	ES584	"	"	MER747	"	"	323	323	"	301
FR-RW87-03	"	"	ES582	"	"	MER905	"	"	324	324	"	302
RW87-04	"	"	ES585	"	"	MER748	"	"	315	315	"	305
RW87-05	"	"	ES586	"	"	MER749	"	"	316	316	"	306
RW87-06	"	"	ES587	"	"	MER750	"	"	317	317	"	307
RW87-07	"	"	ES588	"	"	MER901	"	"	318	318	"	308
RW87-08	"	"	ES589	"	"	MER902	"	"	319	319	"	309
RW87-09	"	"	ES590	"	"	MER903	"	"	320	320	"	310
RW87-10	"	"	ES591	"	"	MER904	"	"	313	313	"	311
FB87-10	"	"	ES592	"	"	MER906	"	"	314	314	"	312

Table B-10-3
FIELD PARAMETERS FOR GROUNDWATER MONITORING WELL AND RESIDENTIAL WELL SAMPLES

Sample	pH	Specific Conductance (umhos)	Temperature[a] °C
GW001-87	6.8	775	14
GW002-87	6.2	2,050	15
GW004-87	6.6	1,375	9
GW005-87	6.7	575	12
GW006-87	6.4	1,275	13
FR006-87	--	--	--
GW007-87	6.9	875	13
GW008-87	6.4	2,500	9
GW009-87	6.1	2,700	20
GW010-87	6.8	530	15
GW011-87	6.3	1,375	8
GW87-01-D	6.6	9,400	15
GW87-03	6.5	1,200	10
GW87-05	6.1	1,000	10
GW87-06	6.7	1,175	9
GW87-06-D	--	--	--
GW87-07	6.7	950	9
GW87-08	6.5	850	9
GW87-09	6.9	1,250	9
GW87-11	6.5	975	9
FR87-11	--	--	--
GW87-11-D	6.3	8,000	9
GW87-13	6.7	850	9
FR87-13	--	--	--
GW87-14-D	6.7	4,750	9
GW87-15-D	6.5	5,500	9
GW87-16-D	--	--	--
GW87-17-D	5.6	1,000	15
GW87-18	6.5	1,200	10
GW87-19-D	6.6	3,100	15
RW87-01	6.9	360	20
RW87-02	6.9	650	20
RW87-03	6.8	340	20
FR87-03	6.9	360	20
RW87-04	7.2	620	20
RW87-05	7.2	510	20
RW87-06	7.2	530	20
RW87-07	7.3	1,575	20
RW87-08	7.4	442	20
RW87-09	7.4	420	20
RW87-10	8.2	620	20

[a]Measured at time of specific conductance measurement

downgradient of the site where the owners allowed sampling to be performed. Samples were collected from a tap closest to the discharge side of the pressure tank. All samples had been pumped but the pump was not always running at the time of sampling. Samples were collected ahead of any in-home treatment systems (e.g., softening). The water systems were purged by allowing the tap to run at full discharge for a period of not less than 10 minutes. Samples were collected directly in bottles from the tap. A replicate sample was collected at RW87-03. A blank was collected by pouring HPLC grade water directly into the sample bottle.

Table B-10-1 presents results of analyses for each monitoring well sample collected. Table B-10-2 presents the results of the analyses for the residential wells. The parameters measured in the field are listed in Table B-10-3.

Well logs are available for the residential wells. However, since the addresses of the residences were not put on the well logs, they cannot be corrolated to individual residences, and thus, are not included here.

SITE SAFETY CONCERNS

Levels of protection during groundwater sampling varied from Level D to Level B as shown in Table B-10-4. Monitoring was done with a Foxboro 128GC Organic Vapor Analyzer (OVA) or with a HNu PI 101 photoionizer. Residential well sampling did not require protective clothing or monitoring.

OBSERVATIONS

A strong sulfur odor was present in samples RW87-04, RW87-07, RW87-09, and RW87-10. The residents of the houses for the first three samples said they had not noticed the smell but the resident where sample RW87-10 was collected said that the water had always had a sulfur smell that was removed in the water softener.

Table 8-10-1

SAMPLE MATRIX FOR MONITORING WELL WATER SAMPLES
PHASE II RI

SAMPLE NUMBER	SAMPLE DATE	RAS ANALYSES									SAS ANALYSES AND LABS								
		CASE NUMBER	VOAS OTR	VOAS LAB	EXTRACT OTR	EXTRACT LAB	METALS-UNFIL ITR	METALS-UNFIL LAB	METALS-FILT ITR	METALS-FILT LAB	SAS NUMBER	LOWER DETECTION LIMITS VOC's	LOWER DETECTION LIMITS PHENOL	LOWER DETECTION LIMITS MERCURY	BOD	COD,TOC	TDS,TSS	Alk,SO4,Cl	Oil & Grease
GW001-87	02/01/88	8938	EF232	VERSR	EF233	HAZLE	MER723	SKINN	MER679	SKINN	3466E	256	256	CRL	277	277	277	277	277
GW002-87	02/04/88	8938	EF283	"	EF284	"	MER731	"	MER732	"	"	(4)	(4)	"	297	297	297	297	297
GW004-87	02/02/88	8938	EF259	"	EF260	"	MER706	"	MER707	"	"	264	264	"	276	276	276	276	276
GW005-87	02/01/88	8938	EF239	"	EF240	"	MER686	"	MER687	"	"	258	258	"	282	282	282	282	282
GW006-87	02/01/88	8938	EF243	"	EF244	"	MER690	"	MER691	"	"	252	252	"	267	267	267	267	267
FR006-87	02/01/88	8938	EF245	"	EF246	"	MER692	"	MER693	"	"	250	250	"	262	262	262	262	262
(1)GW007-87	02/01/88	8938	EF241	"	EF242	"	MER688	"	MER689	"	"	261	261	"	287	287	287	287	287
GW008-87	02/03/88	8938	EF253	"	EF254	"	MER700	"	MER701	"	"	(4)	(4)	"	286	286	286	286	286
GW009-87	02/05/88	8938	EF291	"	EF292	"	MER739	"	MER740	"	"	(4)	(4)	"		298			
GW010-87	02/05/88 02/08/88	8938 8976	EF295	"	EF296	CHEMW		(3)		(3)	(3)								
GW011-87	02/02/88	8938	EF271	"	EF272	HAZLE	MER710	SKINN	MER711	SKINN	"	253	253	"	269	269	269	269	269
GW87-01-D	02/08/88	8976	EF281	CHEMW		(3)		(3)		(3)	(3)					303			
GW87-03	02/02/88	8938	EF249	VERSR	EF250	HAZLE	MER696	SKINN	MER697	SKINN	3466E	255	255	"	270	270	270	270	270
GW87-05	02/03/88	8938	EF257	"	EF258	"	MER704	"	MER705	"	"	(4)	(4)	"	291	291	291	291	291
GW87-06	02/02/88	8938	EF251	"	EF252	"	MER698	"	MER699	"	"	263	263	"	275	275	275	275	275
GW87-06-D	02/08/88	8976	EF275	CHEMW	(3)	(3)	(3)	(3)	(3)	(3)	(3)								
(2)GW87-07	02/02/88	8938	EF247	VERSR	EF248	HAZLE	MER694	SKINN	MER695	SKINN	3466E	260	260	"	274	274	274	274	274
GW87-08	02/03/88	8938	EF237	"	EF238	"	MER684	"	MER685	"	"	(4)	(4)	"	292	292	292	292	292
GW87-09	02/02/88	8938	EF261	"	EF262	"	MER708	"	MER709	"	"	257	257	"	271	271	271	271	271
GW87-11	02/03/88	8938	EF263	"	EF264	"	MER718	"	MER719	"	"	281	281	"	289	289	289	289	289
FR87-11	02/03/88	8938	EF265	"	EF266	"	MER716	"	MER717	"	"	283	283	"	290	290	290	290	290
GW87-11-D	02/03/88	8938	EF279	"	EF280	"	MER727	"	MER728	"	"	280	280	"	288	288	288	288	288
GW87-13	02/03/88	8938	EF285	"	EF286	"	MER733	"	MER734	"	"	284	284	"	293	293	293	293	293
FR87-13	02/03/88	8938	E7287	"	EF288	"	MER735	"	MER736	"	"	285	285	"	294	294	294	294	294
GW87-14-D	02/02/88	8938	EF269	"	EF270	"	MER712	"	MER713	"	"	259	259	"	273	273	273	273	273
GW87-15-D	02/02/88	8938	EF267	"	EF268	"	MER714	"	MER715	"	"	266	266	"	279	279	279	279	279
GW87-16-D	02/08/88	8976	EF277	CHEMW		(3)		(3)		(3)	(3)								
GW87-17-D	02/04/88	8938	EF289	VERSR	EF290	HAZLE	MER737	SKINN	MER738	SKINN	3466E	295	295	"	296	296	296	296	296
GW87-18	02/02/88	8938	EF255	"	EF256	"	MER702	"	MER703	"	"	251	251	"	268	268	268	268	268
GW87-19-D	02/08/88	8976	ES593	CHEMW		(3)		(3)		(3)	(3)					304			
FB87-06	02/01/88	8938	EF236	VERSR	EF235	HAZLE	MER682	SKINN	MER683	SKINN	3466E	254	254	"	272	272	272	272	272
FB87-07	02/02/88	"	EF273	"	EF274	"	MER720	"	MER721	"	"	265	265	"	278	278	278	278	278

(1) Submitted to CLP as GW87-07
(2) Submitted to CLP as GW87-07-FD
(3) Sample not collected due to insufficient volume
(4) Lower Detection Limit samples not collected because of heavy visible contamination or high volatile emissions.

Table B-10-4
LEVELS OF PROTECTION REQUIRED FOR GROUNDWATER SAMPLING

Well Number	Highest Level of Protection During Sampling
GW001-87	D
GW002-87	B
GW004-87	D
GW005-87	D
GW006-87	D
GW007-87	D
GW008-87	B
GW009-87	C
GW010-87	B
GW011-87	B
GW87-01-D	D
GW87-03	D
GW87-05	B
GW87-06	D
GW87-06-D	D
GW87-07	D
GW87-08	B
GW87-09	D
GW87-11	D
GW87-11-D	C
GW87-13	D
GW87-14-D	D
GW87-15-D	D
GW87-16-D	D
GW87-17-D	D
GW87-18	D
GW87-19-D	D

GLT777/71